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MAY 1975
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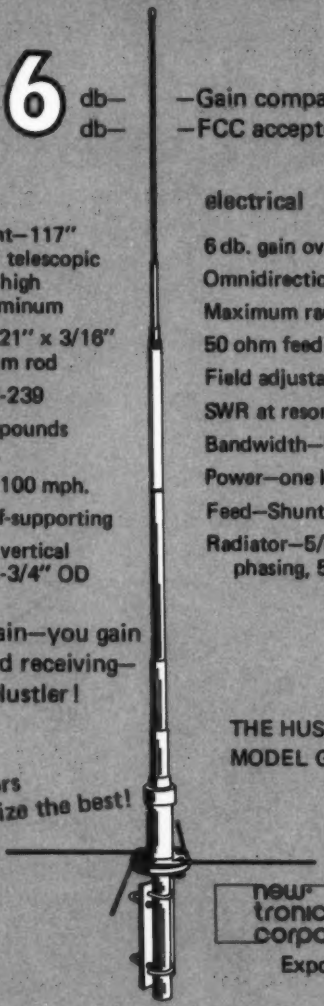

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73 amateur radio

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COVER: Classic 1953 Riley 4 door, available from Peter Marsh, 111 Leroy Street, Binghamton NY 13905. Dress, available from Drazens City of Fashion, Binghamton. Model Karen Kelly is not available.

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73 staff

EDITOR/PUBLISHER
Wayne Green W2NSD/1

BUSINESS MANAGER
Virginia Londner Green

EDITORS
Alex Barvicks WB4RVH
John Burnett

EDITORIAL ASSISTANTS
Susan G. Philbrick
Ernestine Blodgett

PRODUCTION MANAGER
Lynn Panciera-Fraser

ART DEPARTMENT
Bob Drew
Nancy Estle
Neal Kandel
Bob Sawyer

PRINTER
Biff Mahoney

PHOTOGRAPHY
Bill Heydolph

TYPESETTING
Barbara Walker

ADVERTISING
Bill Edwards WB6BED/1
Cathy Greenwood

COMPTROLLER
Knud E.M. Keller KV4GG/1

MARKETING
David A. Behnke
Katherine Pilewicz

CIRCULATION
Barbara Block
Dorothy Gibson
Cheryl Hurd

INVENTORY CONTROL
Marshall Raymond

PLANT MAINTENANCE
Bill Barry

ASSOCIATES
Schley Cox WN9LHO
Tom DiBiase WB8KZD
Terry Fox WB4JFI
W. Sanger Green
Dave Ingram K4TWJ
Joe Kasser G3ZCZ
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John Schultz W2EEY
Waller Scott K8DIZ
Peter A. Stark K2OAW
Bill Turner WAØABI

DRAFTING
Bill Morello
Lynn Malo
T.M. Graham Jr.

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

OSCARING

A couple of fellows got after me at the local ham club meeting to at least listen in to Oscar 7 on two meters – they said I would have no trouble hearing it. The only thing I had handy for this was a Comcraft, so I looked up the satellite schedule in the Amsat column and started figuring out about when I would be able to hear it.

Since my interest arose on an "A" day, I had to wait until a "B" day when Oscar would be outputting on two meters – it puts out on 10m on A days, and I didn't have anything up for 10 at all.

Using the Comcraft – which is an AM/FM rig – in the AM position and with the vfo spotting switch on to provide a substitute bfo, I tuned around 145.95 at Oscar time . . . and there it was! Signals were pouring through. I had no great trouble copying the CW (except some were awfully fast), but SSB called for a very steady hand – I obviously needed something a little bit better than this – like a hot converter for the low band rig. What I was able to copy got me all fired up – OK, G, F, D, SM, OH, ON, PA, UR and things like that were coming through S7 or so.

Vanguard labs agreed to whip up a 144-146/28-30 MHz Model 407A converter. That should do it. I called Cushcraft to see about antennas – they are about the only outfit making circularly polarized antennas. I figured I would get even better results with their twist array on 2m, though my simple vertical was doing remarkably well, even at the end of 100 feet of the VHF resistor we call coax.

Ed Jay of International Telecommunications had the misfortune to call about something – and we made Ma Bell rich talking about Oscar. It ended up with Ed agreeing to send along a Multi-2000 two meter transceiver and with Audioland (one of our advertisers) getting their nose out of joint since the unit sent to me had been earmarked for one of their customers. I'm used to things taking forever, so the arrival of the 2000 via UPS a couple of days later was an event. I just about demolished the box trying to get it hooked up and operating immediately – it had arrived just about five minutes before the last Oscar pass (for four days) on a B day. With about one minute to go I had it working and Oscar was pouring through fantastically – really loud. I tuned around and discovered that the SSB signals were not readable – they were on the opposite sideband! I looked for the switch to change – there was none. With but a few seconds to work on the problem I wasn't sure that I was in trouble, but I was pretty sure.

Ed Jay confirmed my worst fears – the 2000 is upper sideband only. Not that it is a big deal – they have a simple conversion to make it upper or lower sideband – all it takes is a second crystal, a switch and a couple of diodes for the switching circuit. I hate to wait on things like this. When I want to do something I like to get right at it and see results quickly.

On the next B day I was there with the 2000 and a tape recorder, getting all of the CW copy I could. After a few days I found myself filling a shelf with cassettes of Oscar signals. I'll have to take the time to edit these onto one single tape to play at club meetings. If that doesn't make converts, nothing will.

The Vanguard converter eventually arrived – RCA phono plugs, ugh – well, better than BNC. I made up the cables and hooked it up to the Signal One and waited for Oscar – beautiful. Even the SSB was clear now, though I think either system gets down to the antenna noise, so there is little advantage in sensitivity over the 2000.

The next step, obviously, was to get a signal on 432 – preferably on sideband. I started looking around to see what was available – and asking a lot of questions. The basic answer is that there isn't much available. VHF Communications has a small kit available for a mixer to take low level signals from 29 MHz to 432. I sent for one of those. I also sent for the 432 amplifier which would build up the output of the mixer to about 10 Watts.

I checked with Mike at KLM to see how he was doing with his Oscar gear – nothing for 432 as yet, but he has a couple of amplifiers in the works, one with 40 Watts out and one with 70 or 80 Watts. His Echo II SSB 2m transceiver is also upper sideband only from Japan, like the Multi-2000 – they are using USB only over there. He has a simple conversion kit for the EII to get it to switchable sideband. For A day operation on the 2m/10m translator the USB is just fine – it's only when you want to receive Oscar 7 on B days that you need the other sideband.

TPL used to have some 432 linears. I called Tom Litty and talked a good hour with him about the situation – and I may have gotten him interested in giving a listen – that will do it. If we can get Tom bugged to get on Oscar we'll all have some gear available. Tom thought he had a 28 volt amplifier around which might do the job for me, but he got just a bit evasive when I pushed him to change it to Class AB1 for sideband. We'll see. I asked him about using one of the 450 FM rigs, at least for CW – he didn't think much of that – stable enough for FM, but no good for CW was his observation.

Tom thought I might do best to take a couple of T-44 Motorola transmitters and convert them. One could be made into a low level signal source to feed into a mixer at 460 MHz. Subtract from that 28 MHz of sideband from the low band rig in a balanced mixer and then feed the 432 output into the second T-44 and amplify it. Sounds like a lot of work. Tom said he had a balanced mixer around that should do the job, an MD-108 – he'd try to find it and get it to me. I think that getting on 432 sideband is still a way off for me.

Well, there's always CW. I got out an SBE 146/450 transverter that I'd picked up a few months ago from a dealer who hadn't been able to sell it to anyone else. I put the 12 Watts output of the Multi-2000 into it on 144.050 and measured about one Watt dribbling out. The next step is to swing that up onto the tower next to the Cushcraft twist antenna and see if a couple of Watts of CW will break into the club.

Some company is going to start making gear which will produce 432 sideband and I think they will do well. The passband through Oscar is almost empty most of the time – a VE4 working a G4 – K2UYH and his potent signal talking with anyone who shows up – VE2BYG – most of the CW work is done at around 15/20 wpm, so a little practice with the 20 wpm cassette is in order.

HOTLINE EXPANDS

The two month delays on getting hot news out through a monthly magazine is most frustrating to everyone involved. Out of this frustration was born the idea for Hotline – a bi-weekly newsletter with the latest news of amateur radio.

Hotline started out with just four pages and covered DX news, last minute propagation reports, FCC releases, hamfests, auctions, conventions, news items of interest, jobs available in the industry, new products, etc. Now we've added regular West Coast reports, FM news, repeater updates, Novice news, solid state news, Amsat news and Oscar predictions and latest info, six meter hot news, SSTV news and circuits, Hamburglar reports, Ham Help needed and things like that. It's up to twelve pages now – each about double the size of a 73 page – which is like a 48 page magazine each month.

One result of this is that a lot of amateurs are able to keep up with what is really happening – and Hotline pulls no punches, you can bet – which makes for interesting things to talk about on the air and at club meetings – it also makes for better informed replies to the FCC dockets. It's fun to be one of the first to know.

Another result is that club newsletters are beginning to get some good interesting items to reprint, thus making the local newsletters more fun to read. Some Hotline items have appeared in over 300 club newsletters so far, and almost 80% of the newsletters are now including at least one Hotline item.

For $8 per year you can get it from the source – with a first class mail subscription to Hotline. It is usually

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OOPS !

Our thanks to Ralph Taggart WB8DQT, for noting two corrections to two of his recent articles in *73:*

1) "Western Satellite Picture on Your SSTV Monitors", September, 1974, page 81, Fig. 1. In IC4, a jumper should run from pin 9 to pin 2.
2) "What Time is the Next Satellite?", February, 1975, page 48, Fig. 2. The reset line should also go to pins 2 and 3 of IC7.

HOTLINE HEADLINES

Another tower problem – WB2CKB in Linden NJ – over $2400 in costs for the suit so far.

WR2ABK Staten Island repeater provides emergency phone service for 7th and 9th precinct Manhattan police after phone fire.

FCC shelves Class E CB proposal – CB use of 220 docket cooling at least 'til the end of the year – waiting action on amateur restructuring docket, further studies of alternate CB bands.

Letter from retired FCC amateur head strongly suggests fix in the EIA/OTP Class E deal.

Moonbouncers at it again – WA6LET at Stanford Research Institute makes lots of 144 and 432 contacts.

DXCC fees inflate – substantially. $10 for members, $15 for non-members as of June 1. 5BDXCC to $20 and $25!

First Mobile in motion Oscar QSO by G3ZCZ/W8 in West Va. Next it'll be mobile to mobile?

Radio Shack scuttles 2m xcvr – decides market just isn't big enough.

Clegg goes to direct sales with new FMDX synthesized rig to keep price down within reason.

ARRL book prices increase – 33 to 50%!

TV repeater petition entered – for 420 MHz ATV repeater channel.

ARRL 450 MHz repeater plan opposed by Mid-Atlantic Repeater Council.

Bubble DX coming? High power xmtr has been creating bubbles of artificial ionosphere and providing 1000 mile VHF DX contacts.

Radio dealers concerned over move to direct marketing by Genave and Clegg – will Genave go back to dealers?

Buyer beware! Fifteen year old General Class Handbook still being sold by major publisher – hopelessly out of date.

Dying Korean boy saved by ham radio – story makes National Enquirer.

BE MY GUEST

Visiting views from around the globe.

WHO SAID CW IS DEAD?

I've been puttin off writing U this letter now 4 weeks, & U jus may not be there (in the snow) at yr 73 QTH, as I recalled readin somewhere that U & a group wer goin on another DX Europianpedion, that I 4 one wd most certainly wd sure hav liked 2 go on such a trip, but it wd take 2 many words, valuable paper 2 tell U all jus small talk . . . but now, as I type along here, I'm goin 2 wait till I hav an eyeball with the new March 73 issue . . . so jus hang on. OK, Here it is March 2nd, & we've been eyeballin our March 73 issue & we jus haven't sent in our letter on docket 2-282, but wer composing one.

I've jus finished reading over Richard Bash Reform or Die letter, & Let me say that I'm sure very glad that I waited 2 eyeball the March 73. Boy, I 4 one want 2 get his address jus so that we can let hin know that I know plenty of HROs that certainly don't aggree with his views (Oh I realize that you'd naturally be 100% in favor of his views. & I feel that in all fairness that U sure should hav printed his address, as well as his name. & yes, I'm certainly goin 2 do just as Rich said, 2 write 2 those in Sam Rayburn building in Washington 2 tell both them & the FCC 2 leave the code speed exactly where it is, 13 wpm, etc . . . 4 the General & Advanced-Class license. & if they jus can't Hack it. . 2 get a Tech license, & if they just can't get up 2 5 wpm . . . Well then, go & get a Children's Bander ticket, & get on the air . . Mine U Wayne, I'm so very happy that U printed Rich's letter, jus so that I can type more letters out 2 Washington . . & one of em is goin 2 Coldwater as Barry has been spouting off abt that B . . . Nixon who by the way, put in a Guy 2 take his place, that jus as bad as he & Johnson put together & is well on his way along with Kissinger, 2 sending this country on the Rocks . . That B, Warren did a pretty good job of it by putting out "laws" that Stink . . & if this Country had some law on the books like the wonderful Country of SINGAPORE then this so called America would be a thousand times a much better Country 2 live in, & let me say, that I'm Not alone in my thinking, as I've brought up, jus really how wonderful it is in SINGAPORE & just why it is . . as I've talked 2 airline pilots, Ships Captain's & crew members who hav been there in the last 3 or 4 yrs . . & everyone one of em said, yes Kenny, it sure would make a much better State like California a much better place 2 live & work in, if they didn't hav all of these "Beardo's & their friends, Blacks in our State (California) Oh I forgot 2 mention, that all Blacks & Beard'Os with their long hair are "Taboo" & are Not permitted in this wonderful Country of SINGAPORE as this is the "Law" when I was there visiting Doc Charan 9VINR & many others when I flu over from Thailand where I operated with the HR call of HS1AGO. I know that you've been in SINGAPORE, but I just don't know when?

Dr. Young, VE3DDS's article, Mystery of Antenna Radiation is a very good article, but & Einstein's famous equation is very familiar now that some Russian agents tol em abt our secret's . . $E=MC^2$ C=S of L was jus of em . .

Monday, 3rd March . . 0142z . . been readin over the Australian exam's page, plus your Editorial on pg 2 . . Let me say that I think it's jus abt the finest one that U hav ever written, plus HotlineHeadline . . I sent in one of the SF Radio club NEWS, but I jus didn't receive any HotlineNEWS, so I'll send U another one . . The Be My Guest is another very good column that 73 outshines ALL the HRadio magazines, bar none.

Sorry if I jus may hav steped on a few toes, but that's the way we see it fr our window . . even my own Kids wer tol, that if they didn't cut their hair & shave that crap off, they jus weren't welcome . . so they took off a week later & we never heard fr em in 3 yrs, then one showed up, looking like the new Marine ad's in papers & magazine . . & said Dad, I thought at the time, that U should hav yr brains examined . . but it was your way of "thinking" but up untill 2 weeks ago, he said, I felt U wer way out . . then, something hit me out of the "Blue" & I jus can't describe it . . but I know that your 100% correct, & now I'm very glad that U tol us 2 take off . .

. . . Kenneth Mahoney
San Francisco CA

Simple Headache Remedy

During the holidays, with many football games on the one eyed monster, my additional operating time on six meters due to the much enjoyed NCSMA contest activity brought S-9 signal reports from several neighbors. They must have been putting up with it – since I moved to my present QTH last spring – but just didn't complain. They were trying to be nice to the weirdo with all the antennas, I assume.

After computing my effective radiated power with amplifier on and checking it with the TV Overload Chart on page 330 of the 1972 VHF Manual, I figured I have TVI trouble! Any TV within 450 feet of my 1500 Watt ERP SIGNAL would be within average 50 MHz overload range. Just to assure myself of a clean signal from my equipment I tried a 50 MHz tunable cavity filter on the output of my amplifier and found no change in TVI.

Research on the matter brought several interesting possible cures to my problem. One, which I really liked, suggested moving the transmitting antenna further from the TV antennas. The part I liked mentioned that the additional height of the antenna would accomplish this, as well as a lateral movement. Since one neighbor is only 200 feet from my

antenna I would only need to add 210 feet to my present 40 foot tower! The only way to finance such a feat would be to sell all my radio equipment or the house. Since they carry about the same importance I decided to try a less costly approach.

After talking with my neighbors they agreed to let me try several things on their sets. I found the on-off switch to cure all TVI problems while in the off position but I knew better than to suggest that. One set I checked had four conductor rotor cable for the antenna lead in but the owner had a good pic so he could care less how the signal gets to his set. I thought this would have to be changed but found out later it didn't.

I enlisted the help of a local ham to make test transmissions with my six meter equipment at full power and antenna beamed right at the neighbor's antenna. The coordination was carried out via 2 meter FM. With test transmissions I tried two commercial high pass filters. I won't mention brand names as they made no change at all. However, I did not try the Drake TV-300-HP, which I understand is the best commercial filter available. The third device I tried really amazed me: A simple quarter wave length open end stub of 300 Ohm twin lead. This is mentioned in the ARRL VHF Manual but I'll give more credit to a 73 publication entitled "TVI" by W6MOG, which goes into more detail on the stub. A picture on channel 3 which was completely blocked during modulation was perfect with the stub attached to the TV VHF terminals along with the antenna. The formula for this stub is:

$$\frac{246 \times (\text{Velocity Fact})}{\text{Freq of 6M signal MC.}}$$

The average velocity factor of 300 Ohm twin lead is 0.83. I cut the stub a little long to allow for pruning. Starting with 50" I trimmed about one inch off to obtain zero interference on the tube.

One installation had two sets on the same antenna. One stub cleared both sets of any trace of TVI. This is by no means a new method of dealing with TVI, but one which is so simple and cheap that it may often be overlooked. If you have an overload problem, or the next time you encounter such TVI, give the quarter wave stub a try first. You have nothing to lose.

. . . Dex McIntyre WA4ZIA

Reprinted from Newsletter, North Carolina Six Meter Assn.

Bill Pasternak on 20282

If - and only If

Up till now I have shied away from much public comment on this subject because I wanted time to think out all aspects. I have talked to many others on this subject, sat in on meetings where it was the main topic of the evening, and most of all, listened to others talk about it on the air. One thing seems evident: Not too many people have read 20282 thoroughly and many of the ones who did really don't understand it fully. One little tip on the latter: A copy of the Amateur Rules and Reg is all but a necessity.

The topic that brings the greatest criticism seems to be the new Communicator Class license. Not the creation of the class itself, but rather where to put them. My personal belief is that six meters would be an excellent spot. That band is a veritable wasteland all over the country, and one that we may possibly lose if we don't start populating it in vast numbers soon. A couple hundred thousand communicators there might just be a blessing in disguise, but there is an International Regulation against the issuance of a code-free license for any frequency range below 144 MHz. Since the U.S. is a subscriber to the ITU, we must live within this regulation.

Still, we are faced with the fact that we must either grow or "go away." However, if everyone from eleven meters suddenly shows up on two, where are we going to put them all? In Southern California, as well as many other large urban areas, the channel crowding has reached the point of saturation and people still keep coming.

The suggestion has been made to give the Communicator Class all of 220 including full repeater privileges, but with the OTP letter to the FCC pushing hard for Class E CB up there, with repeaters and rather high power level provisions, the entire question of the future of 220 may be a moot point by the time you read this.

There is though, in my mind, an obvious answer to the Communicator question that would make this class a self-limiting one. Simply, give the Communicator all the privileges as outlined in 20282, but make the license itself a short term non-renewable one. Let's say that the Communicator license be issued for a term of 2 years after which the licensee must up-grade to Technician. In that two years the individual will know if he or she wants to stay a radio amateur, and if so there is the incentive to upgrade.

In case you are interested, I feel that the same should hold true for the Novice class, though I go along with a five year license term for it due to the increased code speed necessary to reach the next plateau: General. In either case, Communicator or Novice, I feel that a limited license term would solve both the quantity and quality problem that is on everyone's mind at the moment.

Another aspect of 20282, one that I personally feel needs consideration, is what I term the inequity of its "grandfathering." I simply believe that the right of the individual is far more paramount an issue than that of tradition. If you are going to "grandfather" one or two license classes and show them some form of special consideration, then the same consideration must be shown to all license classes and all amateur licensees. Lest we forget, tradition is a respect for the past and that the *tradition of tomorrow is what we do today*. The constitution upon which our country was founded guarantees equal treatment to all. I feel that we are the "all" regardless of what class license we hold and that to play favorites is not exactly being fair.

I can see no reason to re-examine half the existing amateur licensees just for the sake of re-examination itself. If someone is operating his or her

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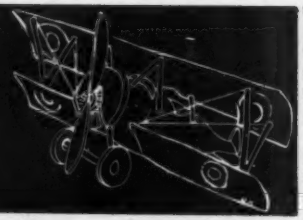
Autobiography of an Ancient Aviator



W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230

I had every intention of diving on the herd as soon as the cowboys had it rounded up, though sometimes this resulted in bullet holes in the wings.

CARLSTROM INCIDENTS

As I promised last month, here are a few of the Carlstrom Field incidents that I think are more or less interesting.

One morning early in March at my 8 o'clock flying line briefing, my instructions were to fly about 10 miles north of Carlstrom and practice loops, each starting at 3000 feet, and keep it up until I could come out of them going in the same direction from which I had started. After this I was to practice barrel rolls without losing much altitude. I was alloted an hour.

Since I had been practicing these maneuvers for some time, and was able to accomplish them satisfactorily, I did a few loops and rolls and then watched some cowboys herding some cattle on the prairie below. I had every intention of diving on the herd as soon as the cowboys had it rounded up. The results of this were always the same — cattle going in all directions and cowboys shooting at the ship. Once in a while you might get a bullet hole or so in the wings.

I was circling and watching the herding procedure out of the left side of the ship when, all of a sudden, there was a sharp jolt. I looked around to see what had happened and found that I had a full grown whooping crane caught in the rigging wires of my right wing. It seemed to be quite dead and the impact hadn't had any effect on the way the ship flew so I headed back to Carlstrom.

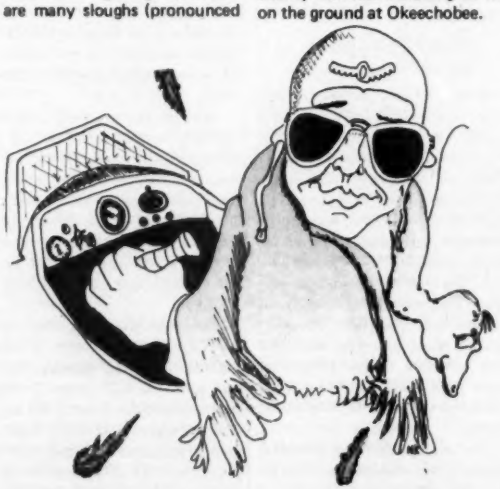
Whooping cranes were not an "endangered species" then. Several times I had observed one flying and had gone over to get a closer look. The crane would usually turn its head and look at me but would never miss a beat of its wings or change course. When these cranes started to go somewhere, they wouldn't let a little thing like a plane change anything.

However, since I had killed one inadvertently, I thought I might as well make the most of it. So when I got back to Carlstrom I put the crane in a barracks bag and took it home. That evening I plucked and cleaned the bird and put him in the oven to roast. Right then I found out that whooping cranes are not an "endangered species" because people kill them for food. This one was so tough that, after hours of cooking, you couldn't stick a fork in him. In addition he smelled so bad while cooking that even the neighbors complained. He joined his feathers in the garbage can.

Then we would short cut the business of frog catching by tossing a hand grenade or two into the water.

One of our forms of entertainment at Arcadia was frog's legs cookouts. There are many sloughs (pronounced slews) in the prairie east of Carlstrom Field. These are shallow streams inhabited by frogs and once in a while a gar. The frogs were very large and in great quantity. So Cleo (my wife) and I with two or three sergeants and their wives would drive out to one of the sloughs and rig a place for a cooking fire. Then we would short-cut the business of frog catching by tossing a hand grenade or two into the water. This would stun the frogs long enough to enable us to net them easily. Then cutting off the legs and skinning them was an easy job. Of course they were delicious dipped in corn meal and fried, together with roasted potato or yams and the best vegetables and fresh rolls we could get from the mess. Some kind of fruit for desert usually topped off the cookout. I might add that no party such as this would be complete without some of Sergeant Bunn's eau d' vie from his still in the enlisted men's mess kitchen.

After we had departed from Carlstrom one of the cadets made headlines in the local papers and got himself "benzined" (discharged) all in one maneuver. The first of several cross country flights in the curriculum was from Carlstrom to Okeechobee City, a distance of about sixty miles, and return. The outbound course was 90 degrees and the homeward bound course was 270 degrees with a small allowance for compass deviation and for the declination from true north which could be easily figured out ahead of time. I made this round trip on March 28th in two hours and twenty minutes including 25 minutes on the ground at Okeechobee.



On June 8th, however, Cadet White left Carlstrom at 8 am and, after two hours flying, arrived at Okeechobee. (Two hours to go 60 miles?) He refueled and took off for Carlstrom. He said he had a ceiling of about 1500 feet under some scattered cumulus clouds. For some reason he thought he would be safer above the clouds so he climbed above. He then flew for about two and a half hours until he ran out of fuel. When he broke through the overcast he was over the Big Cypress Swamp south of Immokalee, about a hundred miles south of Carlstrom. He was unhurt in his crash landing so he smeared his face and hands with engine oil to keep mosquitos off and started walking through knee deep swamp, saw grass, etc. The second day he came upon an old wagon trail which eventually led him to a Seminole village. After spending the night there the Seminoles drove him to Immokalee in a buck-board wagon. He was picked up there by one of the searching planes and flown back to Carlstrom. The part of his story that was the grabber and made headlines was his statement that he ate grasshoppers to keep alive on his way out of the swamp.

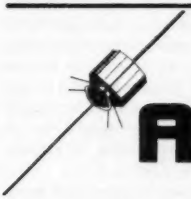
The Carlstrom "Benzine Board" decided that White might do better in some occupation other than flying so they sent him home.

Art Smith, a well known civilian pilot, arrived at Carlstrom with a new gadget that would enable the pilot of a plane to shorten his landing run by reversing his propellor after he had touched down. He demonstrated it several times and it functioned beautifully. It cut his landing run by about 60%. Airplanes didn't have brakes in those days. Then one morning when Smith was on a demonstration flight he came in to land. There were about twelve Jennies in a double line on the edge of the field near the hangars. Art came in low over the hangars and at the last second figured that he needed a little more power to get over the line of Jennies. He must have forgotten that the idling propellor was already in reverse for he gave the engine a quick "jazz." The result was that his Jenny came down like an elevator on top of the line of Jennies and made instant junk out of his ship and four others on the ground. No injury except to his pride. He was before his time on this one.

He accepted every drink that was offered and poured the gin into one canteen, scotch in another, bourbon in another, and mixed drinks in the fourth.

Lt. Wade was Post Exchange Officer and a very fine young man, but he had a problem: "John Barley Corn." With one thing and another, things finally got to the point where Major Ralph Royce, the Post C.O., found it necessary to put Wade "up the pole" (on the wagon) for two months. Immediately Wade got the nickname "BEVO" (a prohibition beverage that was supposed to taste like beer – eccck). Just as immediately Bevo solved his problem by appearing at cocktail parties, and other happenings where liquor was being dispensed, adorned with four army canteens attached to a G.I. belt. He accepted every drink that was offered and poured the gin into one canteen, scotch in another, bourbon in another and mixed drinks in the fourth. When the two months were over it was almost a week before Bevo was back on duty.

Next I'll have an account of my five weeks duty at Post Field and of my transfer to Kelly Field, near San Antonio, Texas.



AMSAT

Oscar 6 Orbital Information				Oscar 7 Orbital Information				
Orbit	Date (May)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (May)	Time (GMT)	Longitude of Eq. Crossing °W
11613	1	0141.4	75.6	A	2084	1	0046.1	61.4
11625	2	0041.3	60.6	B	2097	2	0140.4	74.9
11638	3	0136.3	74.4	A	2109	3	0039.7	59.8
11650	4	0036.2	59.4	B	2122	4	0134.0	73.4
11663	5	0131.1	73.1	A	2134	5	0033.4	58.2
11675	6	0031.1	58.1	B	2147	6	0127.6	71.8
11688	7	0126.0	71.8	AX	2159	7	0027.0	56.6
11700	8	0025.9	56.8	B	2172	8	0121.3	70.2
11713	9	0120.9	70.5	A	2184	9	0020.6	55.0
11725	10	0020.8	55.5	B	2197	10	0114.9	68.6
11738	11	0115.7	69.3	A	2209	11	0014.2	53.4
11750	12	0015.7	54.3	B	2222	12	0108.5	67.0
11763	13	0110.6	68.0	A	2234	13	0007.8	51.8
11775	14	0010.5	53.0	BX	2247	14	0102.1	65.4
11788	15	0105.4	66.7	A	2259	15	0001.5	50.2
11800	16	0005.4	51.7	B	2272	16	0055.7	63.8
11813	17	0100.3	65.4	A	2285	17	0150.0	77.4
11825	18	0000.2	50.4	B	2297	18	0049.4	62.2
11838	19	0055.2	64.2	A	2310	19	0143.7	75.8
11851	20	0150.1	77.9	B	2322	20	0043.0	60.6
11863	21	0050.0	62.9	AX	2335	21	0137.3	74.2
11876	22	0145.0	76.6	B	2347	22	0036.6	59.0
11888	23	0044.9	61.6	A	2360	23	0130.9	72.6
11901	24	0139.8	75.4	B	2372	24	0030.2	57.4
11913	25	0039.8	60.3	A	2385	25	0124.5	71.0
11926	26	0134.7	74.1	B	2397	26	0023.9	55.8
11938	27	0034.6	59.1	A	2410	27	0118.1	69.4
11951	28	0129.6	72.8	BX	2422	28	0017.5	54.2
11963	29	0029.5	57.8	A	2435	29	0111.8	67.8
11976	30	0124.4	71.5	B	2447	30	0011.1	52.6
11988	31	0024.4	56.5	A	2460	31	0105.4	66.2

FINDING OSCAR

The first ascending orbit for each day is given in the chart – this shows the time Oscar will pass the equator going north – and the longitude. Add 115 minutes for each succeeding orbit and 28.7° longitude. A world globe with a 4000 km radius circle around your QTH will show you the area within which you should be able to get Oscar. When Oscar is ascending on the other side of the world it will descend over your area – subtract 166° to get a rough idea of where it will pass – and add 29 minutes to get the time it will pass closest to the north pole coming around. With a little care you will be able to calculate your time of acquisition within a minute for each orbit.

AMSAT-OSCAR 6 and 7 ORBITAL DATA CALENDAR

In cooperation with AMSAT, Skip Reymann W6PAJ has published an AMSAT-OSCAR orbital data calendar containing all orbits for 1975 for both AMSAT-OSCAR 6 and AMSAT-OSCAR 7. Designed so that it may be hung on the wall, the calendar includes information on the operating schedules and frequencies for both spacecraft, and also the telemetry decoding equations. Also included is step-by-step information on how to determine times of passage of the satellites.

The orbital data calendar is available postpaid for $3.00 U.S. funds or 20 IRCs. Overseas orders will be shipped via airmail. Payment should be made to: Skip Reymann W6PAJ, P.O. Box 374, San Dimas, California 91773 U.S.A. All excess receipts over costs will be donated to the space program.

LETTERS

ou goons don't ever proofr
lousy
bunch of rocks
you ignored my
I insist that you print ev

160

160 Mtrs needs people, *NOT* incentive(?) SUBBANDS!

Charles "Skip" Westrich WB8OWM
Canton OH 44709

ANYBODY SPEAK GERMAN?

After being a devout reader of your magazine for the past year and a half, I decided this would be a good time for me to let you guys know how much I am impressed with the caliber of your articles and magazine in general. Presently I am not an amateur but I hope that will change in the not too distant future. Wayne Green has taken the initiative to make this magazine very progressive with his various editorials covering many facets of today's so-called hush-hush topics. I feel that by doing so you have broadened the coverage of your magazine immensely. And by doing so, have most likely opened the doors of amateur radio to many that would not otherwise get into the hobby.

During the last couple of months during a discussion with friends of mine (non-amateurs by the way), topics have come up which have also been discussed in your editorials. I have recommended that they pick up a copy of 73 in order to get some facts about the subject discussed. The usual response is something like: "73, what's that?" or "Isn't that a radio magazine or something?" Well, after letting one or two of them read a magazine or two, I found it difficult to keep up with where my issues were. By the way, it is harder to find a copy of your magazine at the newsstand now. In a way I feel I have created a monster but at least it is more incentive to get that subscription I have been putting off. I don't know if it is sacrilegious or not for me and my friends to be reading your magazine but if other magazines are leery to get into the real topics of today, I guess I will have to be.

I guess the so-called bug has bitten me. In the back of my mind, I have thoughts about what to do with the tax money we get back this year. I have to admit my wife and I have different views on the disposition of this money. At present I am stationed in Germany. I have been a German linquist for about four years now and have just recently spent a year at the Defense Language Institute in Monterey, California. What I need is someone interested in a reciprocal arrangement whereby they could help me learn to be a "ham" and I could help them learn German, thereby opening a new world to both of us. Being here in Germany makes it hard to find an amateur down the block. Wayne Green, "I need help!" Maybe by printing this letter someone can help me get into this apparently fascinating hobby.

SP4 Kenneth E. Wigger
334-48-6711
HHB 1st BN 1st ADA
APO New York 09077

TWO CLODS

As a potential ham I have been reading with great interest your editorials and articles on the declining number of hams in the U.S. With this in mind I would like to relate to you two recent experiences I had.

At present I do not know any amateurs personally. While driving home from work one evening I took a different route than normal and noticed a rather elaborate antenna on top of a home about one mile from my house. As I live in the city I drove up the "common" rear driveway to further inspect this set up. Parked behind the house was a car bearing a license plate with the owner's call letters. I didn't want to invade the personal privacy of this individual by knocking on his door so I copied his call and looked him up in the Callbook. I then wrote him a nice letter asking him if he would recommend a local club or organization I could contact for help in my endeavor. I closed by thanking him for his time and enclosed a self addressed, stamped envelope for his reply. That was almost 5 weeks ago and to date I have not received a reply.

I repeated the same procedure 2½ weeks ago with a different ham – 3 blocks away with the same results – nothing.

Have I committed a cardinal sin? Is this considered a "no-no" among hams? I certainly realize that an entire group can't be judged by a few, but you will have to admit so far I'm batting 1000.

What is the best way to personally contact a ham? Complain about TVI?

Charles F. Super Jr.
Philadelphia PA

To the two clods who did not respond to Charles' polite request for info: Do you think that now, with other services looking greedily at our frequencies, is the time to alienate potential new amateurs? You have given ham radio yet another black eye . . . Wayne.

FRUSTRATED

My guess is that you will have a hell of a time picking out the most representative letter from a bunch of frustrated hams who have been sitting on the sidelines during recent weekends listening to a lot of CQ NR on the Novice bands. I'm one of them so just putting this note together is a good release for a pretty good head of steam that's been building for the last week.

I am prepared to agree that there are a lot of hams who love contests – there must be a million or so judging from what I heard every time I tried to get on the air. It takes a lot of guts to get on the air and chew the rag when you know you must be lousing up somebody's attempt to use the frequency to run up a score. Even if you have the guts, the likelihood of finding another brave soul around in all that mess isn't very probable. I even tried getting up at 3 am one Friday figuring my contest buddies would be asleep from exhaustion or have broken fingers by then but you better believe they are a tough tribe. CQ NR CQ NR DE **** came floating in on the headphones from all over the place.

Now the Novice bands aren't the most spacious frequency slices and to just about wipe them out for two weekends running plus all the time in between seems a bummer to me.

Suggestion — Why not run these contests on an alternate day basis with everyone getting a better chance to do his own thing? That way even the contest nut's family would get a chance to see him at least every other day and the rest of us would have something to do on a cold winter day besides writing frustrated letters to 73.

Carl E. Fogelin
Princeton Junction NJ

SCHOOL RULES

February issue pretty good. Satellite articles were extra fine. I have many school teacher friends and they are always looking for free classroom talkers. I went to my friend's 6th grade class with my 2 meter rig and my 40 meter monobander and a hustler whip. The kids were fascinated. A few will be on their way to Novice. If any of your readers try this, here are a few things I found make it go smoother.

1. Don't count on skip conditions to show off your rig unless you are super sure of the band.
2. Try to bring 40 meter gear as you will be certain to make a contact at least a few states away.
3. Two meter gear sounds like the police and fire department to them. They love it.
4. By all means, bring all the foreign QSL cards you can muster.
5. Get a sked so you will be assured of a contact or two. Kids get bored very easily waiting for your CQ response.

Larry Kahaner WB2NEL
Brooklyn NY 11229

DISGUSTED

My purpose for writing you is twofold. First of all, I want to compliment you on two excellent publications. I'm referring to *73 Magazine* and *Hotline*. These are the best publications I've seen yet for our hobby. I hope I may someday be able to add to your efforts by the way of an article of technical interest or just a story.

Secondly, I have completed composing a letter to the FCC concerning Docket 20282 and my disgust for the same. I found, by reading *Hotline* number 24 that you share the same, or practically the same, sentiments as I do. I personally feel that incentive licensing has seriously hurt the Amateur Radio fraternity and continued meddling with rules and regulations will not make things any better. I detest the petitions filed by outside groups, namely CBers, who have requested rules changes for their benefit. Perhaps, Wayne, a hobby class license in the CB band can be created as a prelude to Amateur Radio . . . *but no one thought of petitioning to change the CB license structure!* I cannot see lowering our standards for those who are unwilling to learn basic code and technical theory nor can I stomach the thought of greater discrimination among operators by empioying several classes of licenses.

I know my single letter to Uncle Charlie won't change anything but I can say I tried to do something about it. Strength is in numbers. If you possibly can, Wayne, do what you can to persuade your readers to send comments on 20282. This menace can be licked by sending telegrams to Washington . . . or, better yet, Amateur radiograms. We must destroy this monster before it destroys us.

R. Perry Awe WA9KNT
Griffith IN

WHAT GIVES?

What really gripes me is the lack of CW on two meters. You know, if you've ever worked either Oscar 6 or 7 as I have been doing lately, the band is full of CW. But after a pass nobody is heard until the next pass. Nobody can tell me they can't get on because I know they have to use the 2 meter uplink for the 2 to 10 repeater. Then come contest time (Jan, June & Sept.) the band is full also. I've been calling CQ beaming to New England every night but no reply. Being an active Oscar user I know they're there. What gives? Anyway I'm on 145 MHz CW every evening, usually around 145.1 MHz. **Danny Clendening WA3WID**
Northumberland PA

Dan, the answer is simple . .. when repeaters developed there was little need for serious DX stations on two meters . . . we could all do better from a mobile rig than we used to with big antennas and high power. Then came Oscar and even greater range was easily available without big towers and beams since a great many serious Oscar users found that their antennas worked just fine down near the ground. Okay, so who is there to work extended groundwave DX on two meters? FMers don't have the equipment for it . . . most Oscar users don't either . . . and that accounts for most of the activity on two meters. If you want to get two meter DXing perking again you'll have to start interesting fellows in the project. I had a great time with it in the early 60's . . . kilowatt . . . big beam up on a big mountain . . . worked out like gangbusters. Now I have a 10 watt FM rig for repeaters and am working on some low antennas for Oscar . . .Wayne.

MISFIRE

I receive three ham mags, but 73 is my only "cover to cover" reading. I note other people are having trouble with Trigger Electronics. I've been trying to get a refund from them for months.

Donald F. Schwab, M.D.
Frederic, Wisconsin 54837

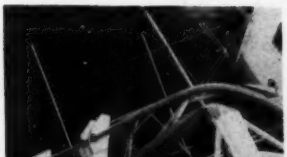
THANKS (YOU'RE WELCOME)

By the way, the response to my ad in Caveat Emptor was excellent! I mailed out ad requests to all the major ham magazines (the BIG FOUR) at the same time, and 73 was the first to publish it. QST was second and CQ and Ham Radio have not yet printed it. Thanks for the good service.

Jim Stitt WA8ONQ
Middletown OH

SORRY, GUYS!

80 mph straight line winds on 10 Jan during 3 storms has put W9CGI off EME temporarily. We will re-build, but weather, money, and parts may delay us until summer sometime. We will keep busy on the gear in the meantime.



We would appreciate any note of our problems to your readers, who may have heard we were almost ready (we were) and would have been on 23 Feb. Sorry guys!

Dave Brown W9CGI
Noblesville IN 46060

H. P. Fischer VE3GSP
1379 Forest Glade Road
Oakville, Ontario
Canada

IC Call Sign Generator

Perfect code at the push of a button.

The sign generator about to be described is a low cost unit that uses conventional ICs in a straightforward circuitry. It generates your call sign in CW or RTTY code by decoding 99 time pulses with logic gates. The unit was originally designed to send my CW call sign at the beginning and end of a RTTY transmission, but it can also be used for automatic station identification in connection with a timer or for generating a "CQ" message in either code.

The circuitry covers a 8.89cm x 12.7cm (3½ x 5") circuit board and runs off 5V dc at approximately 250mA. All required components can be purchased for about $10 from the various suppliers that advertise in 73.

Circuit Functions

Fig. 1 shows a functional diagram of the unit. The circuitry consists of a time pulse generator, decoding logic and a reset switch. Fig. 2 shows a detailed picture of the circuitry involved.

Clock

A SN7400 Quad 2 input NAND gate serves as a gated oscillator. This oscillator generates a square wave at a frequency determined by capacitor C1 and resistors R1, R2. The oscillator functions if one or both inputs of gate 4 are LOW and becomes disabled if both inputs of gate 4 are HIGH. To initiate a call generation, one input of gate 4 is momentarily switched LOW to start the oscillator. Upon the first clock pulse, the second input of gate 4 will be set LOW through a circuit loop and oscillation continues until a stop signal is decoded and the second gate 4 input is set HIGH again. Since then both inputs to gate 4 are HIGH, the output of gate 4 will be LOW and oscillation stops.

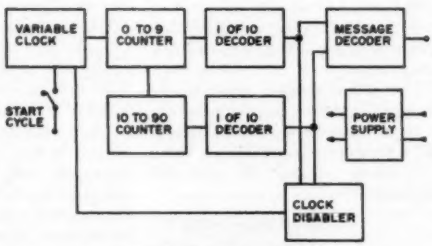


Fig. 1. Block diagram.

Counter and Decoder

The clock pulses are fed to a two stage binary decade counter with two SN7490 ICs. The first stage of this counter produces a binary 0–9 count and the second stage a binary 1–90 count. This is done by connecting the "D" output of the "1" counter to the clock input of the "10" counter. The binary 0–99 count is decoded to a decimal 0–99 with two SN7442 "1 of 10" decoders. Decoder 1 outputs the counts 0–9, and decoder 2 outputs 10–90.

Call Sign Decoder

The call sign is decoded from the decimal 99 time units generated by the counter system. After the most efficient decoding system is worked out as outlined in the

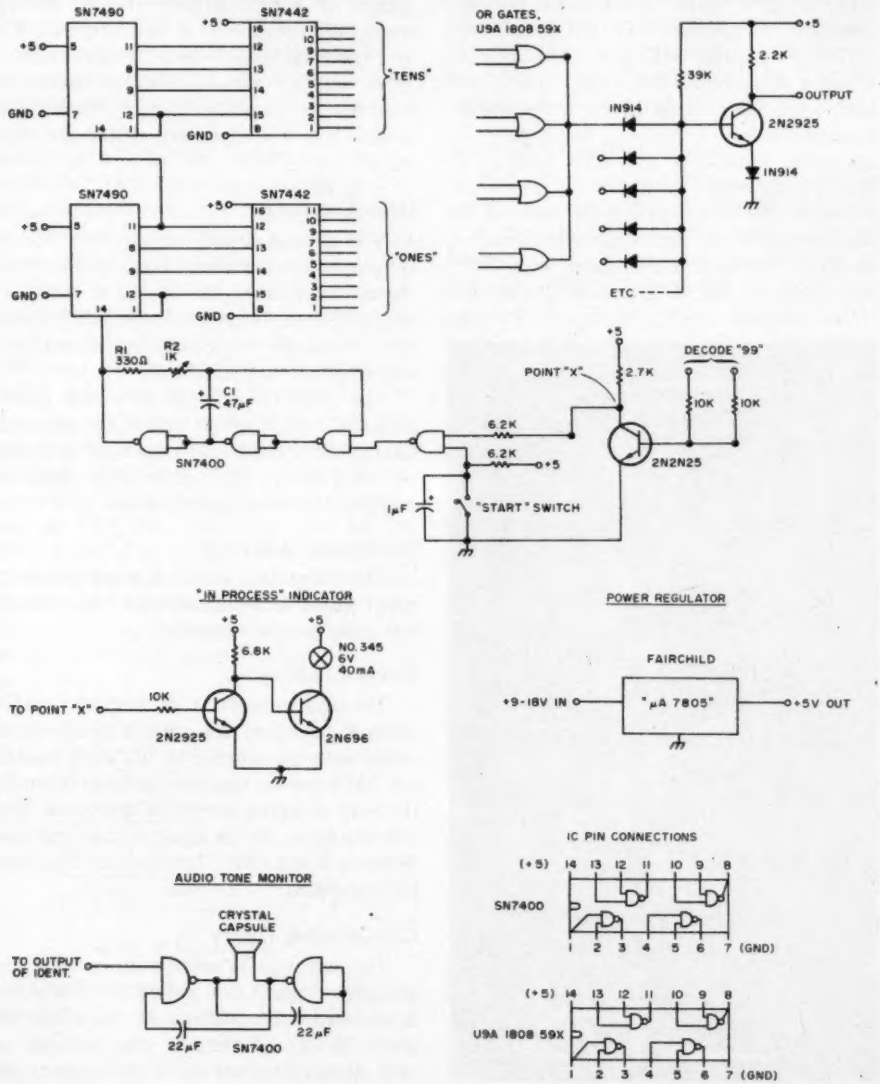
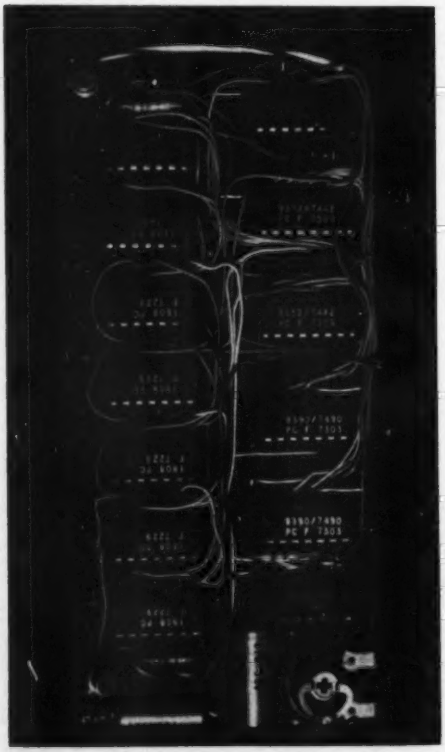


Fig. 2. CW identifier and circuitry.

"Decoding Theory" section of this article, the correct combination of "1" and "10" outputs are fed to a number of 2 input gates. Since the SN7442 decoders give a low output for a desired number, Quad 2-input NOR or OR gates are suitable for decoding the decimal counter outputs. These gates give a LOW output (OR gate) or a HIGH output (NOR gate) for two LOW inputs. TTL or DTL gates are suitable for this function. A suitable TTL OR gate is the SN7432; a suitable NOR gate is the SN7402. I used Fairchild DTL OR gates, the U9A-1808-59X, since they were readily available to me. If SN7402 NOR gates are used, the output of the gates have to be inverted to make them circuit compatible. However, the inversion can be made at the final output if the summing switch circuit is modified. SN7400 NAND gates, or SN7401 open collector NAND gates, can also be used if the decimal counter output is inverted with five SN7400 NAND gates or four SN7404 hex inverters.



IC call sign generator.

If you use DTL 1808 OR gates, as in my circuit, the 4 gate outputs of one IC can be tied together without overloading individual gate output transistors. Ideally open collector OR gates should be used with one common collector resistor, so that all gate outputs can be tied together. In my circuit, groups of 4 gate outputs are fed through decoupling diodes to a summing-switch to give the final output signal. If open collector gates with a common collector resistor are used for the decoding function, the isolation diodes and the summing switch are eliminated.

Cycle Completion

The decimal counter output "99" (or any output of your choice) is decoded to give a signal that disables the clock. At this point of the circuit, a more complex gating system may be installed to permit additional clock enabling/disabling functions.

The "start" switch can be a single pole, 3 position switch which makes a momentary contact on one side and a permanent contact on the other side, permitting single or continuous message generations.

"In Process" Indicator

The schematic shows a circuit addition which turns an indicator lamp ON while the call generation is in process.

Power Regulator

The unit runs off 5V dc at approximately 250mA, although the current consumption varies with the number of ICs used. I used a uA 7805 power regulator chip to make 5V dc from an unregulated 12V dc source. With this regulator, the dc input voltage may vary between 9 and 18V. The regulator chip must be heatsinked.

Call Decoding Theory

The call sign is written up in code and deciphered into LOW and HIGH time pulses as shown in the example of "de VE3GSP" (Fig. 3). To determine the number of time pulses required for a call analyze the call as follows: A dot equals 1 time unit, a dash equals 3 time units, elements within

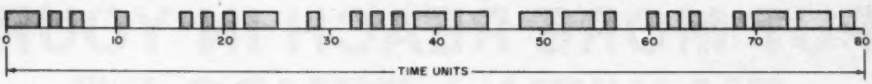


Fig. 3. Pulse train.

one character are separated by one time unit, characters within the same word are separated by 3 time units, and 2 words are separated by 5 to 6 time units. Thus, the 99 time units are decoded according to the call code to give a LOW or HIGH logic level.

To recognize the optimum decoding functions and to determine the most efficient decoding circuitry for your call, draw up a 10 by 10 matrix, Fig. 4, and fill the matrix squares with LOW or HIGH outputs as determined from the pulse train, Fig. 3. The first vertical column shows the output levels for the time pulses 0 to 9, the second column 10 to 19, the third column 20 to 29, etc. Once this is drawn you may discover certain shortcuts that are possible when you decode a call. First, count the number of LOWs and HIGHs required for a call and decode the lesser number of the two. The final output may have to be inverted, but you nevertheless save on the number of decoding gates. Also, other patterns in this matrix may prove to be of major advantage, such as the 7th horizontal line in the author's call, Fig. 4. The whole row turned out to be the same output level and it was possible to decode this row with a single gate (¼IC), by tieing both gate inputs to the 7 of the decimal "ones" counter output.

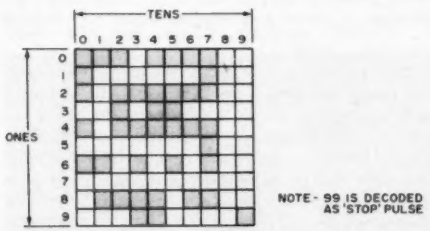


Fig. 4. Matrix Table.

Call Sign Extremes

Obviously, the number of time pulses to be decoded and the number of decoding gates required will vary from call to call. The message "de K5EE," is probably the shortest on the North American continent, requiring only 46 time units. Twenty HIGHs have to be decoded, which requires 20 2-input (5 Quad 2 input) ICs.

The message "de WBQQQ," is likely the longest there is, requiring 104 time units. In cases where the required time pulses exceed 99, the time pulse generator has to be extended to count to 109 or 199, and the decoding becomes more difficult.

Alternate Decoding Functions

The system can also be wired to generate a continuous train of "CQs" in CW or RTTY code. If a 20-pole, 2 position switch is added to the circuit, the system can be used to generate different messages or codes by switching to the next set of decoding gates. If RTTY code is desired, the clock speed must be adjusted accurately to 450Hz (22ms). As each character requires 7.5 (8) time units, the message "CQ de VE3GSP," can be generated requiring 96 time units. Using the 20-pole, 2 position switch, one decoding function may generate "de VE3GSP," plus a return and line feed character (88 time pulses).

Circuit Options

Fig. 1 shows the option of an "in process" indicator light included in the circuit. If an audible tone monitor is preferred, a SN7400 IC can be wired as a gated oscillator, supplying a low power speaker or crystal capsule with an audio tone.

Two different clocks may be used in the circuit, e.g., one low speed clock for CW call generation and a 450Hz clock for RTTY character generation. The clock speed can be changed by switching different values for C1 and R1+2 into the clock circuit.

Conclusion

This unit is easy to build since it uses only one type of decoding gate. It functions beautifully and there is nothing nicer than pushing the "ID" button at the end of a transmission and listening to a perfect code signal.

...VE3GSP

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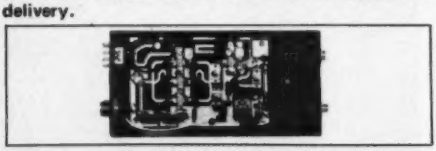

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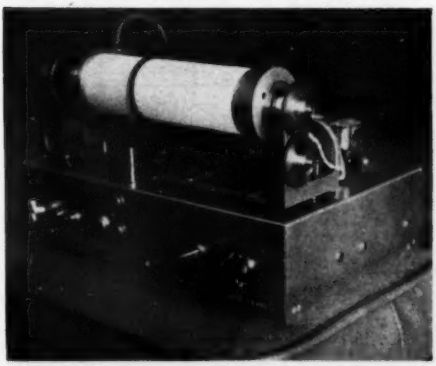
Faxing SSTV

Hard Copy of Slow Scan

It has been my desire to build a slow scan hard-copy machine ever since I got my first fax unit. It seemed to me that a conversion could be made that would do this. Here, then, are the results of that effort.

The device utilizes a regular Desk Fax unit, available for $10 to $15. I used only the mechanism, the ACK button and the power transformer. I chose not to use vacuum tubes in order to save power and to keep the size down. Also, I wanted to explore the use of transistors with high voltage circuits.



Front view of slow scan hard-copy machine.

Since it is not the purpose of this article to provide "build this" information, I will not go into construction details. Instead I intend to show what can be done with one particular conversion, and to explain the operation of such a machine. If anyone wishes to copy the unit, he should take heed that it is only for advanced builders. Much machine shop work is required to build special brackets, bearings, and so forth.

The unit is semi-automatic, and will make a fax type picture from slow scan in less than 25 seconds. If your timing is right you can get a copy in about 17 seconds! This amounts to one frame of synchronizing, and one frame to "burn" the picture. The picture quality is quite reasonable and the unit is capable of 8 shades of grey.

After a basic set up adjustment or two, the operation requires pushing one button until a "run" light comes on; after that it is automatic, and shuts itself off after the copy is finished.

The normal operating procedure is as

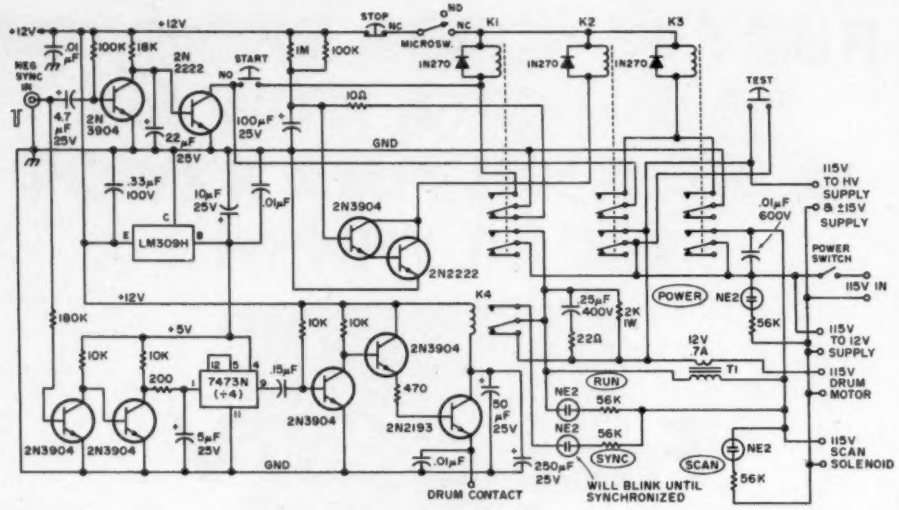


Fig. 1. Logic and control. (All relays shown in relaxed condition.) Note: T1 has windings phased to boost motor voltage by 12 V. All resistors ¼ W unless marked. All capacitors 200 V unless marked.

follows:

1) Turn on power switch and "paper up." ("Contrast" all the way down.)

2) Place stylus carriage in start position at left side of drum.

3) Press *test* button, and hold while setting stylus voltage to approximately 450 V. Release test button. (Motor will run while button is depressed.)

4) Turn up *contrast* all the way.

5) When a slow scan picture is being received on the monitor, press the *start* button until the *run* light comes on at the next vertical sync pulse. The motor will start, and synchronizing will begin automatically. The *sync* light will blink until the

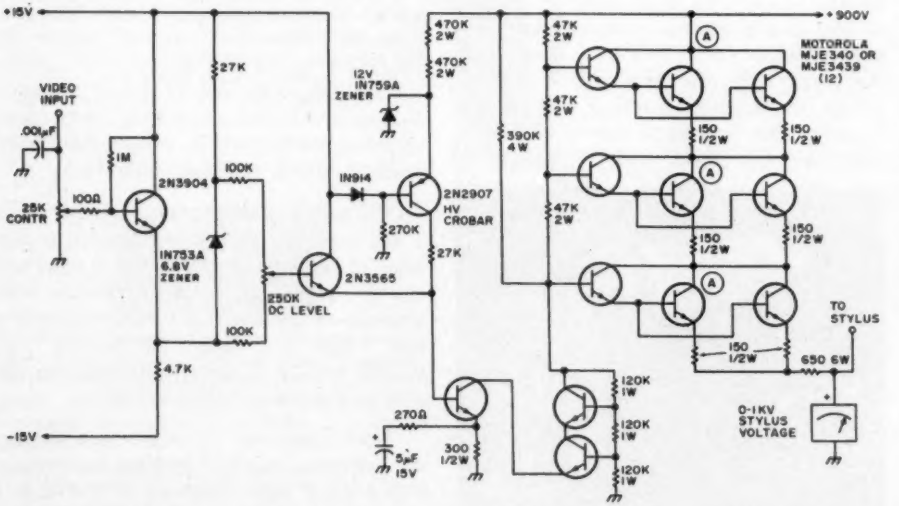
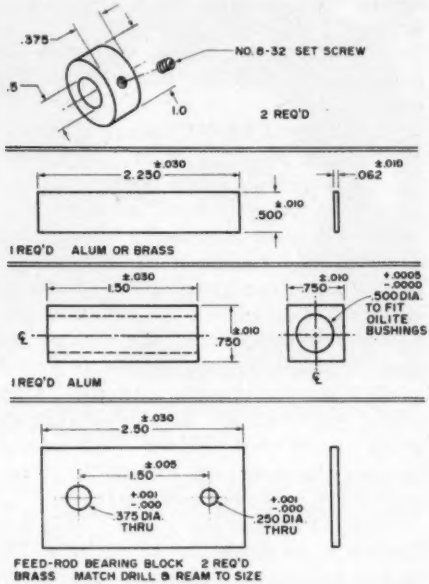


Fig. 2. Stylus driver. All resistors are ¼ W unless marked. (A) transistors are mounted on the circuit board by their leads and a 3/4" x 1½" x 1/32" aluminum heat sink is bolted directly to the transistors in each group of three (heat sinks).



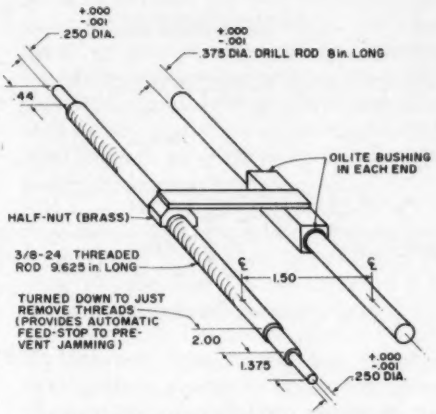

.250 DIA. +.000 -.001
.375 DIA. DRILL ROD 8 in. LONG +.000 -.001
.44
OILITE BUSHING IN EACH END
HALF-NUT (BRASS)
3/8-24 THREADED ROD 9.625 in. LONG
1.50
TURNED DOWN TO JUST REMOVE THREADS (PROVIDES AUTOMATIC FEED-STOP TO PREVENT JAMMING)
2.00
1.375
.250 DIA. +.000 -.001

Fig. 3. Carriage feed mechanism. When stylus carriage reaches end of travel, the half nut will run off the threads and stop feed. Also, the carriage will contact a micro-switch to remove drum motor power and cut off stylus power (this will stop "burn").

motor is in sync with the incoming 15 Hz horizontal sync pulses. K1 is locked up when the motor starts.

6) After about 7 seconds, the timer circuit will energize K2, locking out the sync circuit and enabling K3.

7) At the next vertical sync pulse, K3 will lock up and start the scan by energizing the scan solenoid.

8) At the end of the scan, the stylus carriage will press the micro switch causing *all* relays to drop out, the motor to stop, and the stylus voltage to be removed.

The picture can now be removed from

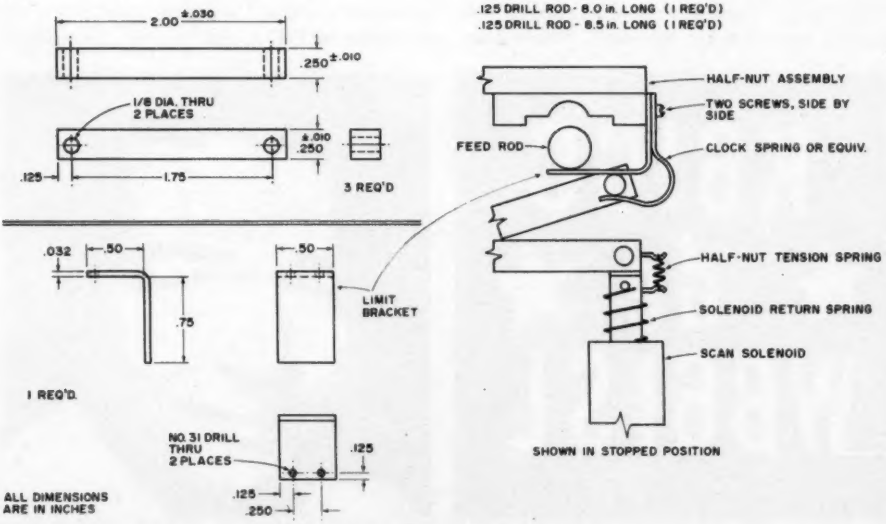


Fig. 4. Scan-engage mechanism details.

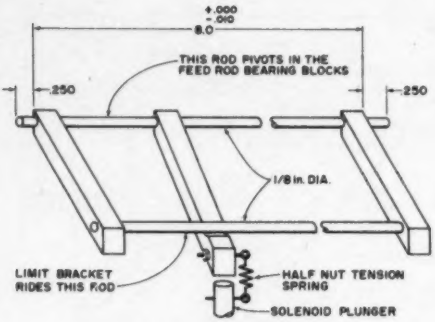


Fig. 5. Scan-engage mechanism.

the drum and a fresh paper installed. Of course, depending on picture content, contrast, or receive conditions, a slight readjustment of the contrast and dc level controls may be required for best results. The picture quality is not as good as a Polaroid picture from the monitor, but at about one cent per copy, they are quite acceptable.

Since the regular Desk Fax paper is too small and also too sensitive to voltage, I use the larger 12" x 19" fax paper cut down to approximately 5-5/8" square. This yields a 5-1/2" picture. Due to the lack of resolution in slow scan, a larger picture would do no good.

At present the drum motor uses the 60 Hz line for synchronism. As a result only "live" copy from a slow scan camera will stay in perfect sync. However, I have been toying with the idea of a servo system employing a phase locked loop to run the drum motor in continuous sync with the horizontal sync pulses, but *that* is quite another project.

The photo of W6HFU's son, Rick, results from a tape recording of an "off the air" slow scan picture. It can be seen that the "skew" or "wiggle" shows up in the horizontal sync pulse as recorded on the copy. The hard-copy machine starts off "in sync," but the tape recorder speed continues to drift after sync lock-out.

The drum sync circuit was, perhaps, the most difficult part of the conversion. At first I tried to sync directly with the 15 Hz pulses, but I quickly discovered that the motor could not recover fast enough between sync pulses. As a result, the motor, quite often, would not come up to speed.

So, I did the obvious. I used a 7473 dual flip-flop IC to divide the 15 Hz by 4. The original fax unit used 20:1 gearing. This unit uses 4:1 gearing. So, instead of one pulse every 20 revolutions, I was getting one pulse every 4 revolutions! Installing the ÷4 circuit reduced this to one pulse every 16 revolutions, pretty close to the original. It seems to work quite well with this set up.

As a point of information the video and sync signals are obtained from the robot monitor. The video is from across the R42, contrast control, and the sync from the collector of Q2. A pair of RCA phono jacks

Live "off the air" from WB6ISL.

Live "off the air" from W6HFU.

Copy from tape recording of transmission by W6HFU of his son, Rick.

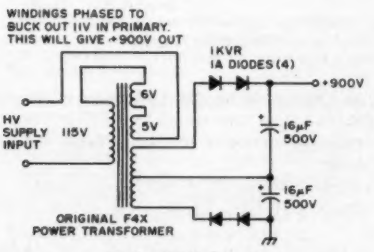
may be installed in the rear of the monitor. This modification will not affect the normal operation of the monitor.

As for mechanical modifications, the motor mounting holes had to be lowered about 5/16" to allow the larger pitch diameters of the new gears. The entire stylus carriage and motors were removed from the original unit. The stylus holder was retained.

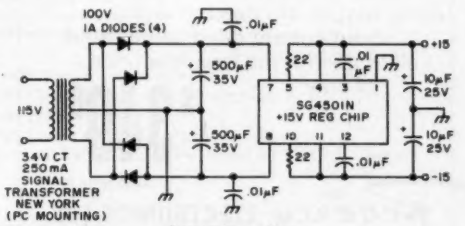
The main drum shaft required a hole in the right end to allow a short piece of ¼" drill rod to be pressed in. This provides mounting for one of the feed drive gears. 3/8"X24 threaded rod with each end turned down to ¼" diameter provides the "lead screw" to drive the stylus carriage. The right end allows mounting the other feed drive gear. These gears mesh and allow the drum to drive the lead screw at the required 900 rpm. This will move the stylus carriage 5" in 8 seconds.

The stylus carriage is a small block of aluminum with a hole drilled through it and a pair of 3/8" (i.d.) bushings pressed in the ends. This rides on a short section of 3/8" diameter ground rod. Both the "lead screw" and the ground rod are mounted in mounting plates that maintain alignment and allow bearing action for the 3/8"X24 lead screw. The stylus assembly is modified and mounted to, but insulated from, the same aluminum block. This forms the stylus carriage. An arm extends toward you from the stylus carriage on which a "half nut" (3/8"X24) is mounted. This forms the "clutch" to engage or disengage the scan. The *scan solenoid* provides control of scanning.

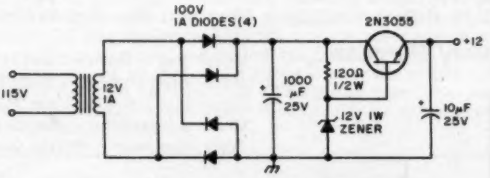
A new, longer drum had to be fabricated. I used a section 7¼" long of 2" (o.d.) brass tubing. However, aluminum tubing would be better, because it is lighter. The original drum is disassembled, and the ends are used again with the new drum.



Stylus H.V. Supply



±15 V Supply



+12 V Supply

Fig. 6. Power supplies. Note: 12 V supply comes on with pwr sw. ±15 V and H.V. come on only in "test" or "run" conditions. This is necessary in order to prevent shock at the stylus!

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FM Scanner Receiver

Because of the type of synchronous motor employed, a flexible coupling must be used between the drum shaft gear and the drum. If this is not done, the motor will not attain synchronous speed! I used some #12 copper bus wire, and wound about 9 turns around the drum shaft, driving one end with the set screw on the large gear bushing and bending the other end into the hole in the end plate of the drum. This is not the most satisfactory way to drive the drum, but at this point I was not being too fussy!

Finally a new stylus had to be made since the original was much too small. The stylus moves .0417" per revolution of the drum, so a hex wrench (.050) was ground and filed to provide a tip .041"X.010". This is the size that seems to work best. The space between lines is almost gone (but no overlap results), to cause a fine "second burn." I tried that too, but found the fine line "second burn" very objectionable.

The resultant copy is somewhat "grainy" due to the slight unevenness of the fax paper and the relatively large stylus required. However, for about 1¢ per picture, I think it is quite acceptable.

I hope the readers of this article enjoy it as much as I did building the piece. It has really been a challenge!

Partial Parts List

K1, 2, 3 – Archer #275-206, 12 V dc relay (Radio Shack)
K4 – Calectro #D1-974, 12 V dc relay (Olson Electronics)
Micro-switch – Archer #275-016 (Radio Shack)
T1 – Olson #TF-027, 12 V, .7 A (Olson Electronics)
Stop button – From original fax unit (ACK button)
Start and Test push-buttons – Olson #SW 452 (Olson Electronics)
Motor gear – Boston Gear, H2412R
Motor shaft bushing – Boston Gear, B-34-6
Drum gear – Boston Gear, H2448R
Drum gear bushing – Boston Gear, B-810-4
Feed drive gears – Boston Gear, G-146 (spur gears)

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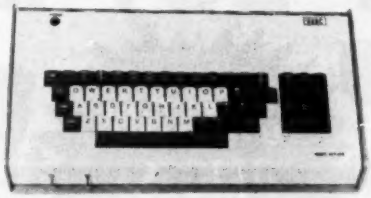

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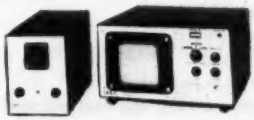

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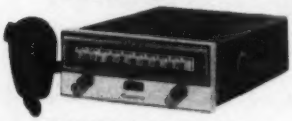

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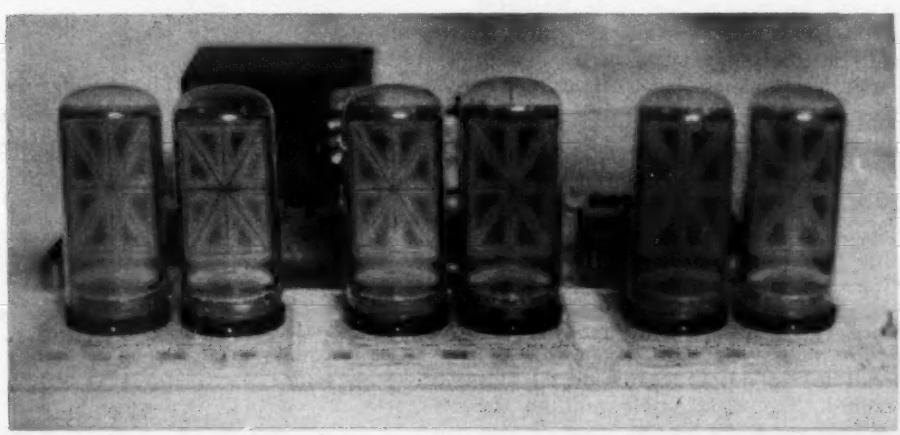
Fat Nixies for Chronometer Nuts

It seems as though every surplus house recently is over-supplied with giant nixie indicator readout tubes. These giant nixies are alphanumeric which means the alphabet as well as the digits 0-9 can be created (along with many other weird combinations). The best part is that these neon filled beauties are usually on sale at quite low prices . . . socket included!

These large nixie tubes (11 x 4½ cm) require the traditional 180 to 200 V dc, similar to that used by their smaller counterparts. The only disadvantage of using these large nixies is the high voltage supply that must be constructed, in addition to a low voltage source for the clock integrated circuit. The extra work constructing the high voltage supply is well worth it, as this beauty will really impress (dazzle) visitors to your shack, such as girlfriends, relatives, etc.

The great majority of clock chips (integrated circuits) presently on the market are of the scanning or multiplex type and are designed to work well driving the LED or fluorescent type readouts. In general these chips are all low voltage, high current devices. Usually, with the fluorescent type of readout, no transistor interface is necessary; however, with LEDs (current hogs) an interface is deemed necessary.



Front view of Fat Nixie Clock showing spacing of nixies and socket mounting in plexiglass base.

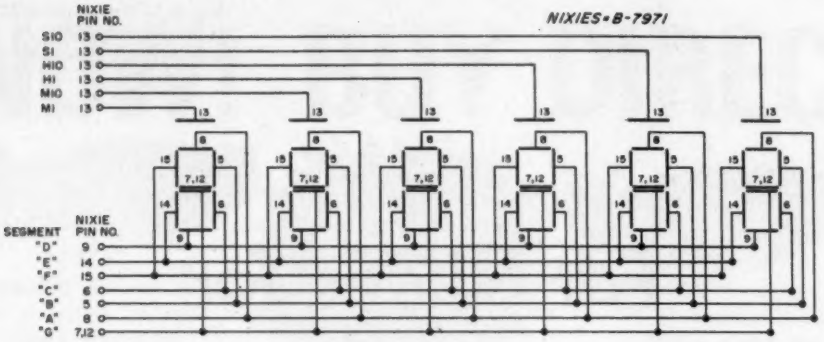


Fig. 1. Nixie multiplex wiring. Note: For "G" segment, pins 7 and 12 are wired together or in parallel. Pins 7 and 12 comprise "G" when both activated.

A high voltage isolating interface is definitely required to operate the giant nixies. By interface, we mean a device that isolates the voltage and current sensitive clock chip from the high voltage required by the giant nixie. At this point we might also mention that the average clock integrated circuit is quite a sensitive device and should be handled with care. Let the IC remain in its static protective foam or whatever until the project is complete and it is time to "plug" the IC into its socket. Even though some of these ICs have zener protected inputs, when you walk across an 8 cm thick plus rug, more than 30 kV can be generated. This voltage can be pretty rough on a $12.00 IC when you discharge yourself via one of the pins. It is wise to ground yourself prior to even touching a large scale integrated circuit. . .better yet is to place both the IC and printed circuit under water then insert the IC. This is almost a foolproof method of insuring that the IC will not be harmed by potential differences.

Anyway, we happened to have a spare National MM-5314 integrated circuit clock chip, so we decided to attempt interfacing it with the outside world of the giant nixie. After destroying many transistors, a circuit finally evolved that worked well.

The most critical part of the interface circuit turned out to be the digit enable circuitry. The digit enable pins on the MM-5314 emanate a negative pulse for digit activation. This is fine for turning on a small low voltage PNP transistor. In the case of a nixie, the digit enable transistor has to be able to handle the "full shot", or 200 V dc for the anodes. A single high voltage transistor in the digit enable system would reflect back excessive voltage to the MM-5314 enable pins. Therefore, a series of transistor switches were used, so as to isolate the MM-5314 from the high voltage and not invert the output switching. If you will notice the digit driver system in Fig. 3, a high voltage transistor (Q13) handles the

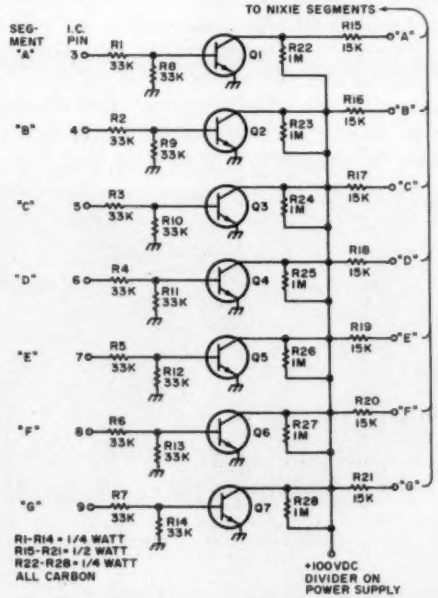


Fig. 2. Nixie segment drivers. Q1-17 — high voltage NPN silicon transistors (Radio Shack nixie driver transistors).

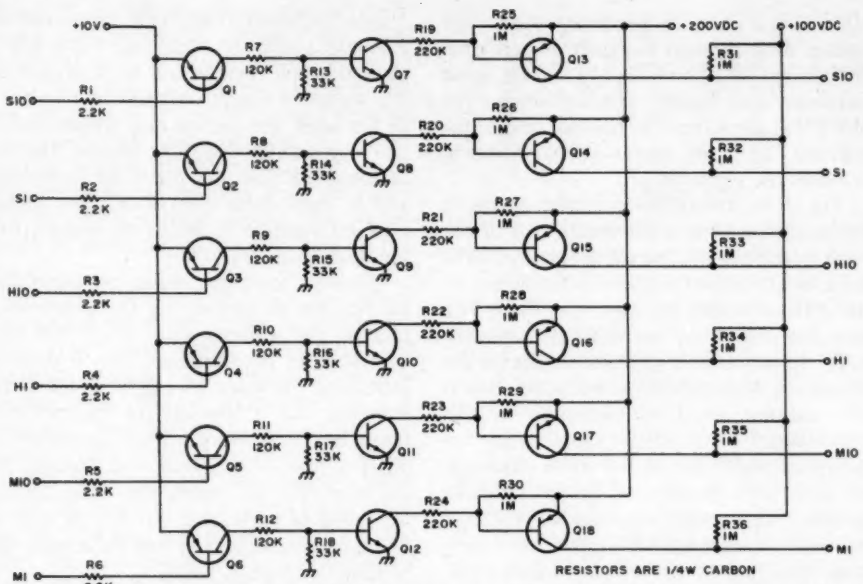
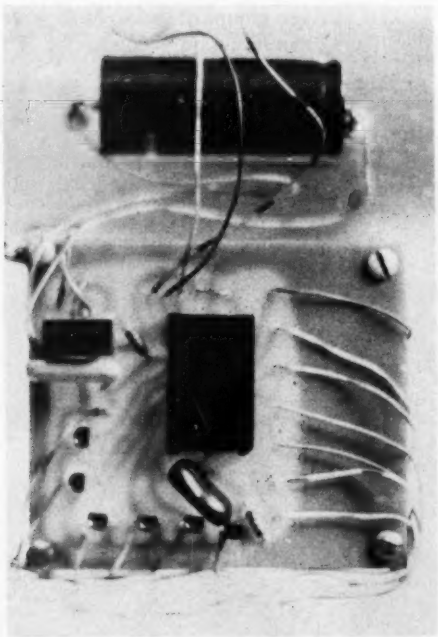


Fig. 3. Nixie digit drivers. Q1-Q6 – 2N4403 PNP silicon transistors, Q7-Q12 – 2N5058 NPN high voltage transistors (Radio Shack RS-2008), Q13-Q18 – Heathkit PNP silicon high voltage transistors.



IC socket board and pre-driver transistors for digits. All boards were mounted to the base with ½" standoffs.

actual switching of the 200 V dc for the anodes. About 150 V dc also appears at the base of this transistor which is reflected back to the NPN driver (Q7) which is also a high voltage type. The 220k resistor between these stages limits the current and drops the voltage as well. Q1 is a low voltage type PNP switching transistor which can then handle the voltage and current limited by the 120k resistor to the base of Q7.

From the standpoint of the MM-5314, the negative pulse given out by the digit enable pins turns on Q1 (PNP) through the 2.2k current limiting resistor. Q1 in turn, turns on Q7 (NPN) with a positive pulse and Q7 then turns on Q13 with a negative pulse. Q13 turns on the digit anodes at the proper time determined by the MM-5314.

The 1 megohm resistors carrying 100 V dc to the collector of Q13 act as a "hold off" biasing system for the nixie anodes so that they will not fire when Q13 is not in the "on" mode or activating that digit. The digit drivers run very cool in normal operation so heat sinks were not necessary.

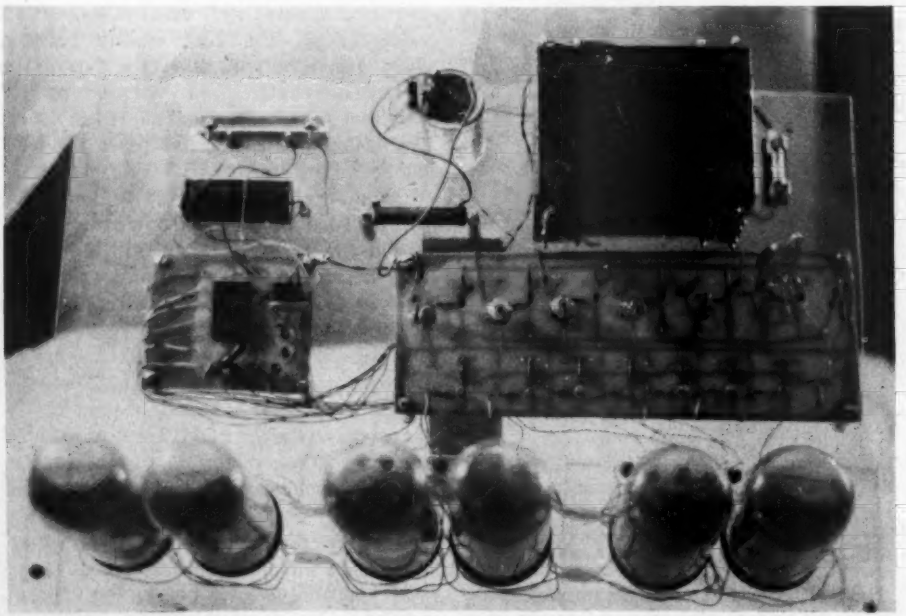
If you will observe Fig. 2, the segment enable system is not as complex. The great amount of high voltage isolation for the

MM-5314 is not as necessary here. The voltage drop through the giant nixie is great enough so that a common 140 V nixie driver transistor can handle the switching. The MM-5314 gives out a positive pulse for segment turn on, so an NPN transistor activates the segments.

Fig. 1 illustrates the multiplex wiring of the seven segment giant nixies. All of the same segments are wired in parallel. The digits or anodes are all individually wired. As the 5314 provides the switching data, at a rate determined by an external capacitor (C3), appropriate digits and segments are turned on. Multiplexing in our estimation is just another word for scanning in this application. At a very rapid rate, the individual digits are turned on in sequence. As each digit is activated in the scanning sequence, appropriate segments for that digit are also illuminated at exactly the same time. This rate of activation is much faster than the eye can respond to so that the entire 6 digit display appears to be continually "on". This is basically similar to a motion picture projector "fooling your eyes" by pulling and stopping the individual frames of film at a rapid rate. Let us take for example a time of 10:25:06. From left to right the first digit would be activated and the segments would indicate the number 1. In sequence, the second digit would activate and segments for 0 would come on. This will continue on until all digits are completed and it then starts over again. The correct time information is fed to the segments via the IC as necessary.

Should "leakover" occur on digits that are not illuminated during the timekeeping process, the scanning rate of the MM-5314 may have to be decreased. This is done by increasing the value of capacitor C3. If the scanning rate is too fast for the particular transistors used, there will be a tendency for digits to leak over. Should you decrease the scanning rate too much, the entire display will blink or pulse. It is not too difficult to find a happy medium so that the display will be stable with no leakover.

The mounting base for the six giant nixies was made from a strip of ¼ inch plexiglass. Holes were cut so as to mount the nixies and sockets in three groups of two so as to space the hours, minutes, and seconds. We left



Top view of clock and plexiglass mount for all components.

about ½" of space between the individual nixies and about 1" between the three groups of two. If you so desire, a pair of neon (NE-2) bulbs could be placed in this one inch space to create a colon between hours, minutes, and seconds. A current limiting resistor of about 100-250k would have to be placed in series with the neons and the high voltage supply. The neons could be cemented in a plastic strip in this space.

In Fig. 2, resistors R15-R21 are current limiters for the nixies. If the value is higher than 15k, the display brightness will decrease. Should you desire a brighter display than that provided by the 15k resistors, decrease their value. If you decrease these resistors too much, transistors Q1-Q7 may overheat and destroy themselves. Should you try a lower value, monitor the transistor case temperature carefully. With the 15k resistors, Q1-Q7 will run ice cold. Resistors R22-R28 are also "hold down" biasing resistors to prevent false ignition of the nixie segments.

The power supply for this clock is not complex and can be made up with a single power transformer. The transformer used must have a 6.3 ac/1 A filament winding and at least a 170 V high voltage winding. The 6.3 ac winding when rectified by a diode bridge and filter capacitor provides between 7.5 and 10 V dc which operates the 5314 nicely. The diode bridge raises the 170 Vdc for the nixies proper. Not a great deal of

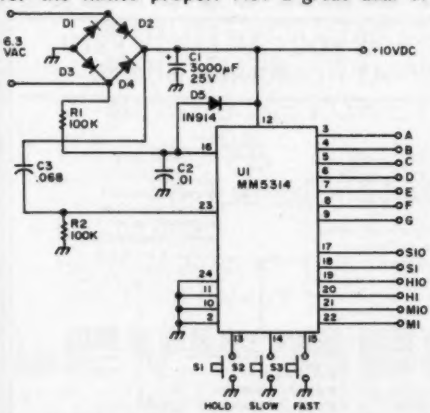


Fig. 4. Main 5314 circuit. S1-S3 – normally open push-button switches. U1 – National MM5314 clock integrated circuit.

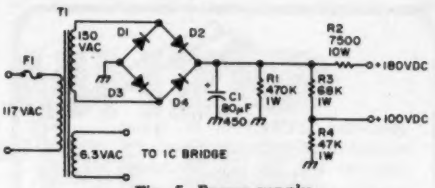


Fig. 5. Power supply.

filtering is required for the nixie high voltage supply as the total current demand is quite low. A small filament transformer and a line voltage doubler could also be used; however, the clock chassis will be hot and may generate a potential shock hazard. It is better to use transformers and isolate the clock from ground.

The accuracy of this clock is maintained by your local power line 60 cycle source. Plus or minus a few seconds per month is a good average for accuracy. I have noticed that the power companies must make corrections in their 60 cps frequency and the clock will also correct as the power companies compensate.

When first applying power to the "FAT" nixie clock, check first for signs of smoke. If all is well, all or a few digits will light and the seconds indicator will be counting. Press the "fast forward" switch and run the clock completely through an entire 12 hour sequence. We have noticed that when first applying power to this particular IC, its brain will be confused and it will read something like 35 hours 15 minutes and 12 seconds. By running it through a rapid 12 hour sequence, it straightens out the brain logic and it will keep accurate time from then on. Momentary power failures (less than 30 seconds) will not upset the IC timekeeping functions as it continues to run for a while on the low voltage filter capacitor charge.

Setting the clock is accomplished with the fast, slow and hold switches. With a little practice, it's a snap to set this clock. Make sure that you include a line fuse as this clock will be running on a continual basis.

PARTS LIST

Fig. 2.

R1–R14 33,000 Ohms, ¼ Watt carbon resistors
R15–R21 15,000 Ohms, ¼ Watt carbon resistors
R22–R28 1 megohm, ¼ Watt carbon resistors
Q1–Q7 High voltage NPN silicon transistors (Radio Shack Nixie driver transistor)

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Fig. 3.

R1–R6 2200 Ohm, ¼ Watt carbon resistors
R7–R12 120,000 Ohm, ¼ Watt carbon resistors
R13–R18 33,000 Ohm, ¼ Watt carbon resistors
R19–R24 220,000 Ohm, ¼ Watt carbon resistors
R25–R36 1 megohm, ¼ Watt carbon resistors
Q1–Q6 2N4403 PNP silicon transistors
Q7–Q12 2N5058 NPN high voltage transistors (Radio Shack RS-2008)
Q13–Q18 Heathkit PNP silicon high voltage transistors, #417-295

Fig. 4.

C1 3000 microfarad, 25 volt electrolytic capacitor
C2 0.1 microfarad, 100 volt disc capacitor
C3 .068 microfarad, 100 volt disc capacitor
D1–D4 1N4002 silicon diodes
D5 1N914 silicon diode
R1–R2 100,000 Ohms, ¼ Watt carbon resistor
S1–S3 Normally open push-button switches
U1 National MM5314 clock integrated circuit

Fig. 5.

C1 80 microfarad, 450 volt electrolytic capacitor
D1–D4 1N4005 silicon diodes
F1 1 Ampere, 250 volt fuse
R1 470,000 Ohms, 1 Watt carbon resistor
R2 7500 Ohm, 10 Watt wire wound resistor
R3 68,000 Ohms, 1 Watt carbon resistor
R4 47,000 Ohms, 1 Watt carbon resistor
T1 120 V ac primary, 150 V ac secondary at 100 mA. 6.3 ac, 1 Ampere secondary.

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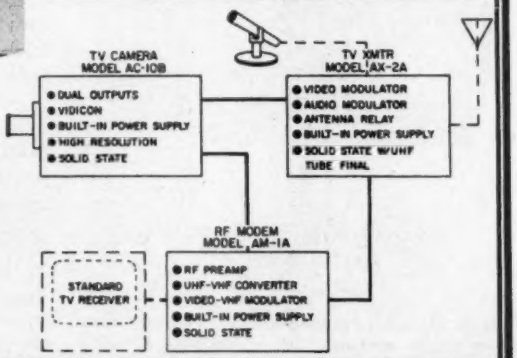

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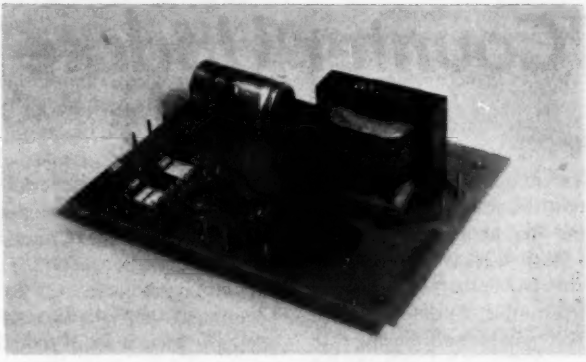

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Latest K2OAW Counter Update

Also Updates QST's Counter

After a quiescent period of a year or so, it seems that the season has re-opened on comments on the excellent frequency counter by Pete Stark K2OAW. The latest is the article in the November issue of 73 entitled "Latest Counter Update" by the original author, K2OAW himself. Seeing four photos of the counter I built included in the article (on page 29) blew my head up to at least double its normal size and prompted me to trot the old typewriter down to the local stationery store and have it cleaned so that I could get in my licks, too.

The original article was one of the better construction type articles I've seen and helped my counter to have a minimum of "birth pains." It did have a couple, though, and Pete put up with an awful lot in reading my letters (and I'm sure those of others) and answering them.

I added an extra digit stage to my counter to give it a 6 digit read-out instead of the 5 in Pete's counter, and also included "switched" decimal points which switch to the correct positions by means of added poles on the kHz-Hz and hi-lo switches. This necessitated at least one switch slightly more exotic than those usually available in stores; a four pole double throw miniature toggle switch. These are available from such places as Allied Radio and Newark Electronics, and nowadays are showing up in radio stores that have the IR switch display racks.

For ease of servicing and modifying, and also to permit construction in one of the small surplus CB (whatever that means) cabinets that I bought several years ago from Brigar Electronics through an ad in 73, I built the unit using all plug-in PC boards – 6 for the digits, one for the control circuits and clock and one for the input circuits. This meant that I had to make some double sided PC boards for the digit boards, a first for me. So I tried another "first," making boards photographically instead of the usual (for me) hand drawn circuit boards. EUREKA! It worked great!

I used seven-segment LED read-outs mainly because they look nice, are small and the power supply need supply only 5 volts. This led to another complication, as per Murphy's law – current drain. Being the world's most ignorant person when it came to ICs (at that time), I had no idea how much current the whole thing would draw, and blithely used the LED read-outs which use a pretty fair amount of current. Plus, I added the extra digit with its additional ICs. When I was finished I discovered that the whole thing drew something approaching 2 Amps, way over the limit of the LM-309K 5 volt regulator. I managed to get a Sanken S1-3554M regulator through another 73 ad. This has the same T0-3 case, but is rated at 5 volts at 3 Amps. It does a good job. The regulator still got quite warm, however, and I wanted to keep heat down as much as possible, so I replaced some of the ICs, but not all, with the low-powered versions. The 7490s in the clock divider section were all changed plus a few of the others. This helped a lot, too.

The above were minor things I did, but

there were two things which I feel considerably improved my counter. As Pete mentions in his update, different builders had different experiences with the input sensitivity. I don't really know how many millivolts it takes to drive the counter, but I found the sensitivity when using the prescaler to be quite satisfactory. The low frequency input, however, was something else again. It really needed a walloping signal to count. I fooled around with the 40673 and its associated circuitry, but never got the sensitivity to where I felt it was good. In an equipment report in another magazine there was shown the input circuitry of the HUA Model 1BC-1a frequency counter. This looked fairly simple and the report gave it a fairly good sensitivity rating, so I took out the original circuit and replaced it with that shown in Fig. 1. Things might work out differently for different people, but this improved the sensitivity of my counter to the point where I'm quite happy with the whole thing.

Pete also mentions in his update article the various problems (or lack of problems) different builders have had with stability of the oscillator. I wrote International Crystal about it, before building the counter, and they suggested that I not use an oven, saying that they felt their HA crystal (which Pete suggested) would do as well, or better. They were right, it does a fine job. Even so I still had a very slight drift. In K2OAW's original article he listed 2 capacitors in series with the crystal in the oscillator. These were a

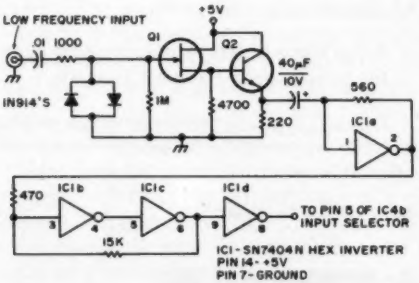


Fig. 1. Input circuit. Resistances are in Ohms; K = 1000 and M = 1,000,000. Q1 – MPF 102, HEP 802, Q2 – MPS 3563, HEP 720.

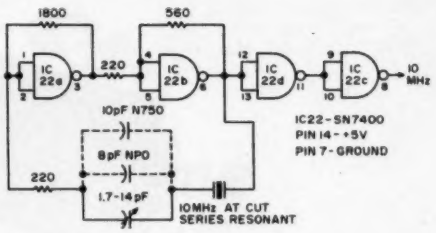


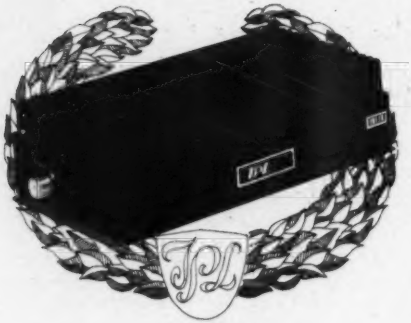
Fig. 2. Alterations to 10 MHz crystal oscillator. The two capacitors shown with dash lines replace the 33 pF capacitor in the original article. Some experimentation may be required to arrive at correct values.

1.7-14 pF trimmer and a 33 pF NPO in parallel. I changed the 33 pF to two separate capacitors, making a total of 3 caps in parallel, all in series with the crystal. Replacing the 33 pF cap with an 8 pF NPO and a 10 pF N750 really made the thing settle down. It just doesn't have any noticeable drift. Different crystals might mean different values, but a little experimenting will soon determine the correct ones.

Now that all is said and done, I really have a superb instrument. It will perform as well as a lot of commercial instruments (and better than some) available at far greater cost. It has been used by a number of the locals to align and put on frequency their 2 meter FM rigs, and also, in conjunction with a not too great signal generator (which it transformed into a lab instrument), to align HF rigs. On top of that, it looks great reading out the frequency of my Drake T-4X transmitter when I'm on the air. Incidentally, I used two input connectors instead of one, mounting one on the front and one on the rear panels. They're selected from the front panel by means of a toggle switch. This way I can leave the input from the T-4X connected to the rear jack and when I want to use the counter for test purposes, merely switch to the front jack. No taking the counter down from the shelf to disconnect and reconnect, along with the associated knocking over of things from the shelf (Murphy again!).

Now if Pete will only come up with a circuit for a 3½ digit Digital Multi-Meter, I'll have something to do for another year.

. . . WB2UKP



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How to Become a Famous Author

You can easily become a Big Wheel in amateur radio – a ham's ham, so to speak – by writing articles for amateur radio magazines. Read on, and I will tell you the secret of how to become a Big Author.

As you read the simple rules below, you will probably think I'm oversimplifying. "Impossible," you'll say, "it can't be that easy." Nonsense. Follow the foolproof method below and you can't go wrong. This approach is based on an actual case which has worked for others before you, and can work for you, too. To convince yourself, whip out your old copies of *QST* and *73 Magazine* and see for yourself.[1,2,3]

Rule 1. Start by deciding which magazine to write for. This is a crucial step, because you have to make a basic decision – what do you want most: fun, fame, or fortune?

Let's talk about the fortune first. The choice is only between a tiny fortune and no fortune. Of the four amateur radio magazines, three pay for their articles and one doesn't. The problem with getting paid for an article is that every dollar you get is one less dollar on the magazine's profit sheet.[3a] That means that the editor will examine your article that much more carefully than he would if he didn't have to pay you for it. That obviously won't do. And that brings in the fun part – you can't have much fun writing an article if you're constantly worried about doing a good job.

So the best bet is to give up the fortune – it's only a tiny one anyway – and concentrate on the fun and fame. You can have both by writing for *QST*. A long time ago I had a *QST* editor tell me that the reason *QST* doesn't pay for articles is that authors should consider it an honor to write for such a prestigious journal. He said it was like writing for one of the famous scientific journals. Obviously writing for *QST* will be a great honor and make you famous.

Rule 2. Pick the right source for your information. Everybody knows that electronics wasn't invented in a day. It's much too complex for everybody to be an expert on everything, and it's only understood that you will base your work on the work of those who came before you. It's obvious that you won't be inventing something new for your article – if you did, you'd be out patenting it and peddling it in the nearest electronics store.

As an author, you have an obligation to base your work on the work of other authors before you. After all, imitation is the sincerest form of flattery. But you must make sure you pick the right sources for your article. This one crucial point can make or break your article.

You may at this time have some qualms about just how much you can "borrow" from a prior article. Let me assure you that,

---

[1]To be a successful author, you have to learn how to write footnotes and references, so here's your first lesson:

[2]Arlo R. Eggensperger W2TJZ, "Frequency Counter – A Modular Approach," *QST*, January and February, 1975.

[3]Peter A. Stark K2OAW, "A Modern VHF Frequency Counter," *73 Magazine*, May, July, and September, 1972.

[3a]*What* profit? – Ed.

as long as you borrow from the right article, in the right magazine, you need have no such worries. A *QST* editor once wrote the following to me:[4,5]

> "I'm sure you realize that an article can't be rejected simply because it is similar to one which appeared in another publication. The exception would be, of course, in instances where the designs were original and patented. Most of the large corporations like GE, RCA, Westinghouse, and others hold the patents on almost any circuit configuration that is in common use today. Therefore, it would be most difficult to claim originality for anything but the collection of circuits we house in a cabinet."

See, you can borrow as much as you like from another article in a *magazine other than QST* without worry.

Your best bet would probably be to borrow from an article in *73 Magazine*. You see, the editors of *QST* and *73* don't always see eye to eye on a lot of things. That means that even if a *QST* editor should spot some similarities between your article and an earlier one in *73 Magazine*, he won't be too concerned. Most important, if in your efforts to do a good job you should get a bit overzealous and, heaven forbid, *copy* a bit of the original article from *73 Magazine*, the original author might complain to *QST*. But the *QST* editor will merely answer that an article can't be rejected simply because it is similar to one that earlier appeared in another publication. That gets you off the hook.

Rule 3. Pick the right article and subject area. Doing this crucial step properly will save you a lot of work later. Pick the right article to borrow from and your job is half done. There are several criteria to follow:

1. The original article must be at the right level. You can't achieve fame by writing about simple stuff. On the other hand, pick a difficult subject and you will be inundated with letters and questions, some of which you may not be able to answer.

2. The original article must be fairly long. It's hard to write an 11-page article by borrowing from a 5-pager. Takes too much work and cuts down on the fun. The best source article is one which is substantially longer than what you intend to write. That way you can pick and choose and thus really exercise your creative talents.

3. The original article should have a lot of diagrams. It's hard to borrow a lot of text, because you have to rewrite it or paraphrase it, and that takes thinking. Diagrams, on the other hand, can easily be disguised by following the simple steps in Rule 5 below.

The original article must be fairly long. It's hard to borrow an 11-page article from a 5-pager. Takes too much work and cuts down on the fun . . .

4. It must be about a reasonably popular subject. It's no fun writing something nobody will read.

5. Of all the different areas of ham radio, something having to do with digital circuits is best, for a number of reasons. First of all, there are millions and billions of different ways of putting together a digital device, and they obviously can't *all* be patented by the big corporations. With luck, just by arbitrarily juggling things around, you might accidentally invent something new.

Second, because there are so many different ways of doing the same thing, everybody will *assume* that your circuit will be different from all the others, even if it should turn out to be a carbon copy.

Actually, with digital circuits it is very easy to borrow an entire diagram from another article and dress it up so nobody will recognize it. You see, some time in 1974 *QST* changed to a new set of digital symbols which are completely different from those used by almost every other magazine. For example, one of the simplest logic elements is a NAND gate. Everybody else draws it as a

[4] Your references need not always be to other articles. This example shows you how to properly reference other material:

[5] Doug DeMaw, Technical Editor, *QST*. Letter to the author, dated January 20, 1975.

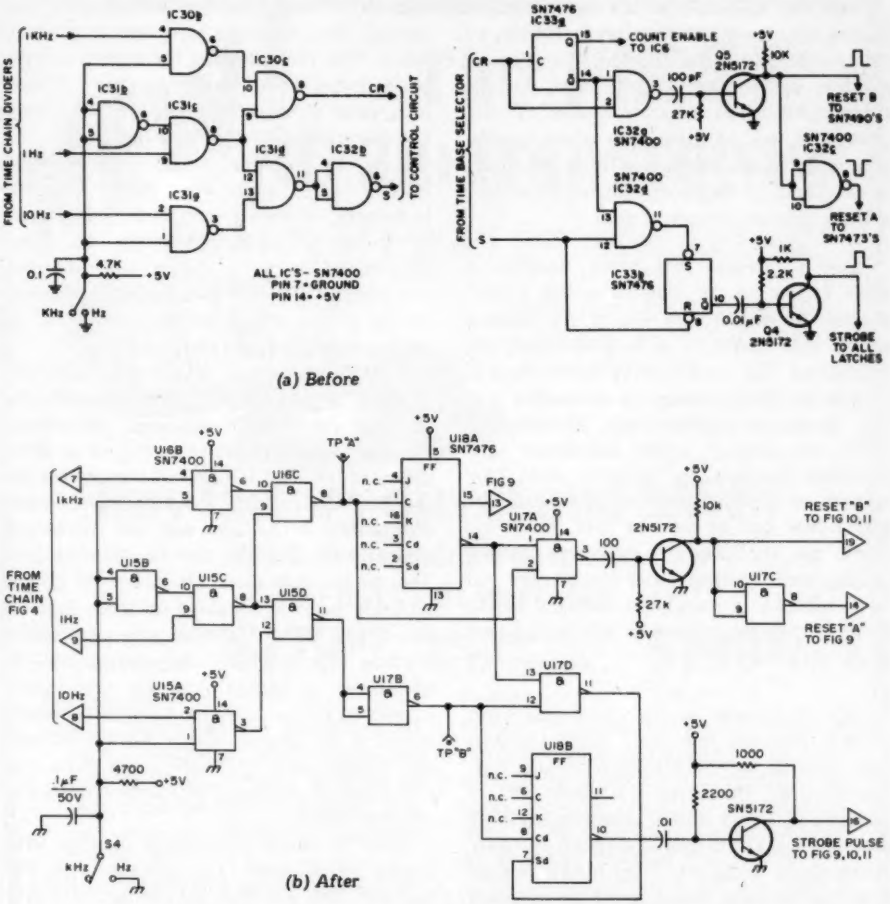

Fig. 1. How to change a diagram by using different symbols, and then combining two smaller diagrams into a larger one.

half-circle with a tiny round dot on the output lead. But *QST* draws it as a square with an "&" sign inside, and a funny looking arrow on the output. Using this new set of digital symbols you could reprint all of *QST*'s 1972 digital articles in 1975 and few readers would be any the wiser.

Rule 4. Butter up the original author. Having decided which article to borrow from, now's the time to apply a little psychology. Some day the author of that article may discover your article and feel you have done him in. This is obviously a very childish attitude, since he should realize that imitation is the sincerest form of flattery, and he should be happy that you have chosen his work to copy. Nevertheless, you have to go out of your way to prepare him for that shock. So take the initiative — write him a real nice letter, telling him how much you enjoyed his article. Make him feel really good, which will make up for the fact that later he will feel really bad. Some gooey phrases like, "The articles show real creative thinking and planning. They are very complete and very well written," would be very appropriate.[6]

[6]Arlo R. Eggensperger W2TJZ. Letter to the author, dated July 3, 1973.

Rule 5. Camouflage all the diagrams. Having taken care of all the preliminaries, we start by preparing the diagrams. This process involves several steps. Make sure you do them carefully, as they are crucial to your success. If any of these steps seems unclear to you, by all means dig out those old copies of *QST* and *73 Magazine* referred to earlier, and see how the process is done.

Step 1. Redraw the block diagram, if there is one in the original article. (Don't bother drawing a new one if the original article didn't have it, as it is obviously not necessary.) You must be very careful here so as not to change things so much that you ruin them. As a general rule, changing the inputs or outputs a bit should be safe. Different symbols for grounds, coax connectors, or switches will help, too. You can add a new box or two, or split up an old block on the diagram into two blocks. Change some numbers, and maybe even put in a mistake or two, like wiring a switch backward. Presto, change-o: You have a new block diagram.

Step 2. Change all the old digital logic symbols into the new ones. Since the new logic symbols are much more confusing than the old ones, this alone is a major step in camouflage. Don't bother changing anything small — look at the overall diagram and only change those things which are readily noticeable. For instance, changing the pin numbers on a small diagram is a waste of time.

Change all the old digital logic symbols into new ones. Since the new are much more confusing than the old, this alone is a major step in camouflage . . .

On the other hand, it pays to change a few component values and perhaps transistor numbers. For example, if an original circuit uses a 33 pF capacitor in a certain place, feel free to change that to 75 pF. Just to cover yourself (in case the new value doesn't work), put in a note that says SEE TEXT, and in the text explain (in small print) that if the new values don't work out, the reader should feel free to change them.

As a second example, suppose the original author used a lot of 2N5172 transistors in his circuit. Chances are that he did so because he had a junkbox full of them, not because they were the only ones that would work. You shouldn't use the same transistor because it will look suspicious. Instead, look into your own junkbox to see what your favorite transistor is, and use that.

Step 3. Combine several small diagrams into a larger one. This is an excellent technique, because it changes the appearance of things so much that only the most determined reader or editor will ever spot the similarity. Fig. 1 is a beautiful example of the Before and After diagrams when we apply these successful techniques.

Fig. 1, by the way, shows one pitfall you should stay away from; it applies specifically to fairly complicated drawings. This circuit has ten two-input gates, contained in three different SN7400 ICs. All of these gates are exactly the same and therefore interchangeable; in the same way, the two inputs on any one gate can also be interchanged. This means that there are about 30 billion *different* ways of hooking up these gates in the circuit shown. Thus if you were really starting from scratch, the chances are 30 billion or so against you that you would happen to pick exactly the same pin combinations as the original author did. Even if you just change a pin or two here and there, you will avoid all suspicion of having copied the original circuit.

Step 4. Break up a large diagram into several small ones. The trouble with the previous step was that, by combining several small diagrams into a large one, we were reducing the total number of diagrams. But now we make up for that by doing the exact opposite.

In all of these steps, don't worry if there is something in the original article that doesn't seem to make sense to you. Occasionally the original author will include some circuit trick like mixing up IC inputs and outputs in some inexplicable way. It doesn't pay to try to figure out exactly what he is doing. Simply take his word for it that it's a good idea and include it in your diagram as well.

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Rule 6. Write the new text to go with the new diagrams. From now on it's all downhill. You have the new diagrams, and all you have to do is to describe them in English. What could be simpler than that?

If you can't think of anything original to say, use a trick known as Taking A Step Backward. The great beauty of this technique is that it is so unexpected that everyone, even your closest friends, will be amazed at your brilliance. To Take A Step Backward, you simply find a few good features in the original design and *omit them.*

If you can't think of anything original to say, use a trick known as Taking A Step Backward. It is so unexpected that even your closest friends will be amazed . . .

For instance, suppose the original author used a regulator IC in his power supply. To Take A Step Backward, forget about the IC and use a Zener diode and three or four transistors instead. After all, isn't 5% regulation 50 times better than 0.1% regulation?

Better yet, suppose the original author went to the trouble of designing a printed circuit board for his project, and included it in his article. To Take A Step Backward, don't tell the reader about the board layout, but make him build it the hard way. This Step Backward has several unexpected benefits.

First of all, you would have been in dire danger if you had included the circuit board layout in your article, as it is probably copyrighted as part of the original article, and you don't want to mess with the FBI.

Second, suppose the original article described some fairly complicated project like a frequency counter, and gave a board layout which mounted all the parts on one board. Break up the parts among a dozen or more boards, tell the reader to use a resist pen to draw his own patterns, and call it a "modular approach." Right away you can spend pages and pages telling the reader why a modular approach is such a great technique. If the readers only knew that using all those little boards instead of the original board layout is going to cost them a lot of time, effort, and wire, they would of course feel you had sold them a bill of goods. But with luck they will never find out.

Finally, don't include the layouts for your hand-drawn boards in the article. For one thing, parts of them might possibly look a bit similar to the board layout of the original article. Moreover, the more difficult you make the job for the reader, the more he will admire your work.

Rule 7. Do not give any credit to the original author. There is only one person in the whole world (besides you, of course) who can fully appreciate the true beauty and great design of your article, and that is the author of the original article you borrowed from. DO NOT GIVE HIM ANY CREDIT. I cannot stress this highly enough.

Most men are basically selfish and mean, and the original author is no exception. No matter how slight the resemblance between your article and his, he will immediately suspect you of the most vile and unjustified actions if he ever happens to see your article. This would be especially embarrasing in this case, as your article may resemble his prior article very much. So do not, under any circumstances, do anything which might call his attention to it. Most important, do not list his article among your references, lest some friends of his (if he has any friends) see it and tell him how nice you were to refer to him.

Of course, to be a successful author, you must learn to use all the tricks of the trade, and one of these is to include plenty of references to earlier articles, if only to show the reader you know what's going on. This seems to lead to a contradiction – what articles do you reference if you can't mention the one article you got all your information from? Simple – find three or four older articles which have very little to do with your own work. For example, a few references to some articles on how to make printed circuit boards would be just fine.

Rather than go on and on with more, I will leave the rest to your imagination and inventiveness. You are probably itching to sit down at your typewriter, so why not give it a try?

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Playing With Power on 432

This article describes the construction, operation, and measurement of a breadboard type rf amplifier for 432 MHz, including the complete testing of all components and their parameters, and a second amplifier mounted in a minibox which can be used either as a driver or a modulated final.

Following my usual system, only new transistors are used, so that unless the manufacturers abandon the type early, you will be able to procure them for the next few years. Of course an awful lot can happen in solid state in a small number of years, but at least you're starting off with a good and available device.

Developing enough crystal-controlled rf voltage for use in amplifiers at UHF is always a serious problem. The tripling exciter described elsewhere works perfectly, but like most tripling systems, each stage has less rf output in milliwatts as you multiply up in frequency. Articles in 73 Magazine several years ago described a favorite tube exciter of mine which used doubling and high gain tubes in every stage to get to 432 MHz, increasing power with every multiplication of frequency on the way up, so that the last doubler – from 216 to 432 MHz – had about 5 W of output. Low-cost transistors are not up to that just yet, but wait a few years or so.

The crystal controlled exciter using tripling makes an excellent small size local oscillator, signal source and test unit, but for use in a transmitter I suggest the doubling method exciter.

Adding one amplifier to the last doubler brings the power up to where it lights a No. 48 bulb on 432 MHz. Really dim, but you can see it. From measurements with the do-it-yourself milliwattmeter this is close to 15 mW.

There is space enough in the minibox exciter for that rf amplifier. I might just put one in there a little later on.

Type Of Transistor

There are unfortunately some thousands of different types of transistors, but what saves the day for us is that there exist some manufacturers of good devices who also remember the amateur homebrewer. It also helps that the entire management, engineering, and technician ranks across the country contain large percentages of amateurs. So Bill Ashby, President of KMC Semiconductors, Long Valley, NJ, sells some of his excellent 2N2500 series for $5 with the number H104. This is it for our purpose here. It multiplies as high as 2500 MHz, and I find that in practical circuits as described, a useful gain of 8–10 dB is obtained. The circuit and construction shown using these transistors can easily accommodate other devices.

Do-It-Yourself Milliwattmeter For Rf

Believe me, when you're working on low-cost battery portable UHF rigs, this item is something you really need. You lads who work in the industry, with an rf power meter on every bench for every technician, think it's easy, but what about when you're in your own shack, tuning up a battery rig for 432 MHz? Then what will you do? You've got some rf – it moves a meter attached to a diode – but how many Watts? Of course it won't be Watts, it will be milliwatts, unless you invest in plenty of dollars for high power devices, so you suffer. Cheer up, here's how not to suffer: For the price of a few No. 48 light bulbs, a 100Ω pot, and less than half a day's work, you can measure from 15 to 180 mW of rf power. And nothing stops you from making a few more, with different scales up into the 5 W range, using the same circuit but a different bulb. A glance at a light bulb chart will show you all kinds of Watts available. So, enough of the sales pitch, here comes the circuit in Fig. 1.

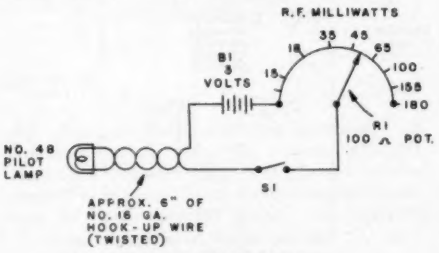

Fig. 1. Rf milliwattmeter

Simple enough, and you just can't make a mistake here – after all, it's dc! Hardly any explanation is needed until you come to calibrate the dial, and even then you just connect a dc voltmeter across the bulb and put a 0 to 100 mA meter in series and adjust the current times voltage to convenient round numbers in milliwatts, like 15, 20, 30, 50, 100, 150 or as many points as you wish.

To operate the milliwattmeter, position bulb A, which is lit by dc, close to bulb B which is attached to L1 as in Figs. 4(a) and 4(b), turn the 100Ω pot until the dc bulb A matches the brilliance of the rf bulb B, as in Fig. 1, and read milliwatts from the calibrated dial. You cannot have *less* than the dc rating, although you may have a little more rf power. It is particularly useful in checking gains of rf amplifiers at these frequencies. This gain, by the way, is not the easiest thing in the world to come by.

The Breadboard Amplifier

This is a real experimenter's unit, spread out so you can change and test almost anything pertaining to a transistor power amplifier on 432 MHz. I feel a little guilty at times using the word "power" when we're beginning with just a few milliwatts, but you have to tell it like it is.

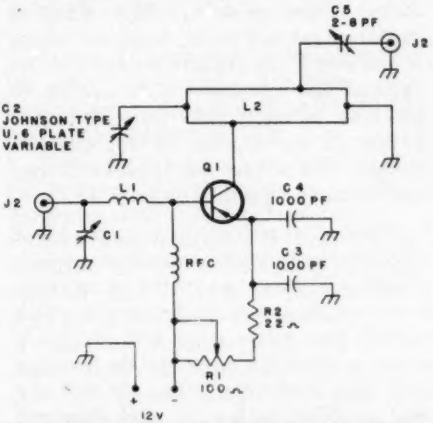

Fig. 2. 432 rf power amplifier breadboard. J1, ceramic phono jack; C1, mica compression trimmer, Arco 400; L1, 3½ turns No. 18 bare tinned copper, 3/8 in. long, ¼ in. OD; RFC, 50 turns No. 40 enamel (surplus choke, not critical); R2, 22Ω 10th Watt; Q1, KMC, H104. L2, see Fig. 3; J2, ceramic phono jack.

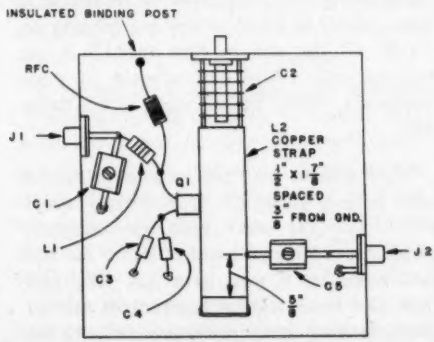

Fig. 3. Breadboard amplifier layout. Q1 case is the collector. Solder to L2.

After all, if you put our three main considerations together – low cost, 432 MHz, and solid state – you will find that it means low power. And don't forget, you can always add, later. So keep this breadboard around for testing that big device, if and when you get it.

Figure 2 shows the schematic, and Figure 3 the layout. The input jack at the moment is the ceramic phono type, and it works. A base input inductance L1 is used with C1 for matching, and they do a pretty good job as evidenced by testing with different lengths of cables from the preceding unit, which is the doubler method exciter ending up on 432 MHz. An rfc is used from the base to the dc ground, which in this case is the negative battery lead. No external bias was found to be needed for this base, as the rf drive from the exciter pushes Q1 up to some 10 mA collector current. The emitter was bypassed by two small ceramic capacitors C3 and C4.

The emitter resistor needs quite a bit of attention, as usual. Some transistor power circuits use things like 1/10th of an Ohm, so you see what I mean. I started out with a 100Ω pot, with a safety unit of 22Ω in series, and then got down into the less than 1Ω range later when testing the unit as a final amplifier, with a lot more drive and 25 mils of collector current. It does need some resistance, which is also a safety matter. At present I have a 10Ω pot in there as R1, but may change this after modulation tests. Remember that when modulating you need a 24 V transistor if your supply is 12 V. We're specializing on 12 V on the theory that the 12 V car battery will figure importantly in your operation, both mobile and from those hills.

You may or may not be able to light a bulb with rf from L1. If you can't, use a driver like the next unit, the minibox amplifier, which is another name for the first amplifier if you have just two, and then the final will be beyond 50 mW or more, making things easier to start with for tuneup.

After tuning everything up to a maximum I was able to obtain a cherry red glow from just one amplifier after the exciter. This turned out to be close to 15 mW. Figure 4 shows how to match a No. 48 bulb into L1 at 432 MHz. C1 is a copper tab ¼ x 3/8 in., soldered with a 1/8 in. lead to the bulb. The tip of the bulb is soldered to the side of L1, as in Fig. 4(b). Believe it or not, this really loads Q1. C1 is probably of the order of .1 or .2 pF, but that is what it takes at 432 MHz.

When the amplifier is used as the final – that is, driven by the breadboard for one example, or by another similar amplifier, which brings the original doubler output up to a just-visible 15 mW – the bulb lights very brightly and you can relax and really tune things up, check cables, start feeding beams, etc. Every time I say tune things up I don't just mean turning capacitor screws. I mean maybe trying different ones, trying different straps, different connections – in fact, really working with everything there.

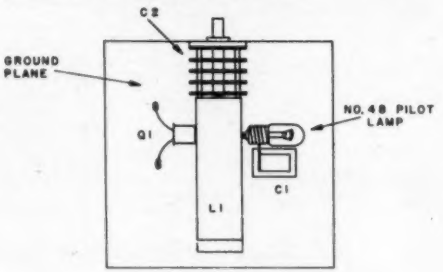

Fig. 4(a). Rf bulb details.

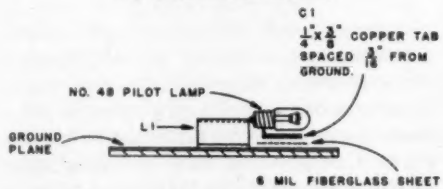

Fig. 4(b). Rf bulb details.

You can also use the rf voltmeter method with the tuned diode to peak things up first. It's just that I like to *see* that rf lighting up something.

So, by now, your rf final should be working away at a gain of 8–10 dB, and you can begin to think about getting on the air.

Minibox Rf Amplifier For 432 MHz

There is a little aluminum box size that is just right for the 432 MHz amplifier. Breadboards are an absolute necessity for checking out components, methods, and circuits, but for assembly into a rig for carrying around, you need a box.

The one I have in mind is 2 in. wide by 4 in. long by 1¾ in., and the amplifier strapline and the Johnson type M variable fit nicely inside. Getting right into details, Fig. 5(a) shows the schematic and Fig. 5(b) the layout.

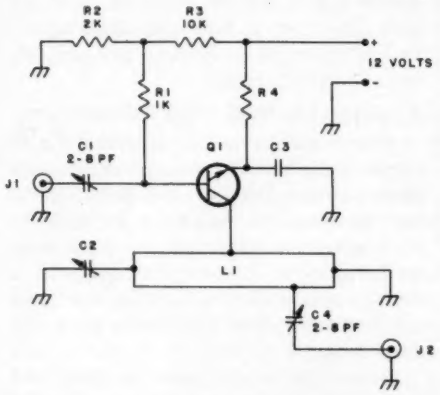

Fig. 5(a). Minibox amplifier schematic. C2, Johnson type M, 160–104, 9 plates total; C3, brass plate capacitor, ¾ x ¾ flat brass bolted to ground with nylon bolts, 6 mil fiberglass insulation; L1, brass strap, or copper, ½ in. wide, 2¾ in. long, spaced ¼ in. from ground. J1, J2 – ceramic phono jacks; R4, 22 Ohms.

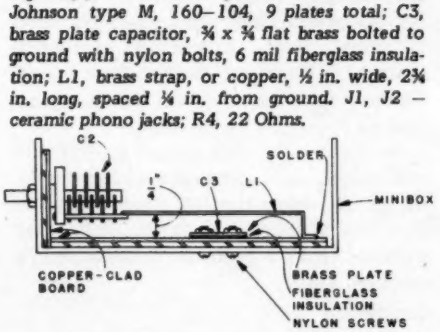

Fig. 5(b). Minibox amplifier detail.

What could be simpler? Actually it will work right away, providing you pay attention to certain basics as listed next.

A. Use a good copper-clad ground plane inside the box.

B. Make L1 as shown.

C. Connect C2 properly to L1, use a vertical continuation of the ground plane, and solder on an extra ground connection for good luck. See Fig. 5(b).

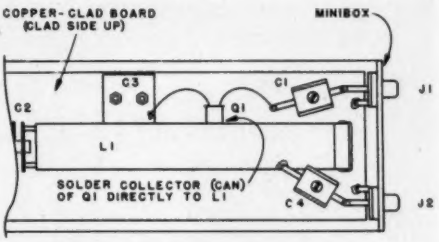

Fig. 5(c). Minibox amplifier detail. Q1 is close to the middle of L1.

D. J1 and J2 need large ground straps for the outer connections. The inner cable connections must go directly to C1 and C4. *No* leads at all! See Fig. 5(c).

E. Solder the transistor case, which is also the collector of Q1, directly to L1. Use a small iron, small solder, and small time.

F. Use a good brass plate capacitor for C3.

G. Solder the base resistor R1 close to the base terminal, or wire, so that no more than 1/8 in. of resistor wire is left.

H. Work on the emitter resistor value of R4. A good rule is to start with a 100Ω pot, put a limiting resistor of at least 22Ω in series, and you will soon get the hang of it.

You can use either the breadboard or this one for the first amplifier. It just happens that I used this one, the minibox, as the first stage. Of course I'll have to build a second minibox one in order to assemble the whole affair into a workable and portable rig, but that's coming.

If everything is made right, you will find C1 and C4 going to jacks J1 and J2 very useful for matching and getting power into and out of this amplifier. Some people prefer an inductance in the input, as in the breadboard amplifier, Fig. 2. Both methods are shown here; it's your choice. They both work well.

Note that some dc bias is used on the base of this amplifier. This is one reason for using it as the first stage, because the exciter may not furnish enough drive to

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generate all the bias Q1 may need in order to be fully turned on.

As usual, things happened. In Fig. 5, C4 couples the power out of the first amplifier into the second one. This is a mica compression trimmer, and several times while tuning up I noticed a tremendous jump in current in amplifier No. 2, but assumed it was self-oscillation. Never again! C4 was shorting, which applied 12 V positive to the base of Q1 of Fig. 5. Two 2N2500's, also numbered KMC type H104, bit the dust on that one! I took the trimmer out, and by looking closely in a good light, found half of the mica missing. Live and learn, they say. If only you could earn – instead of spend – on those bloopers, life would be a little easier.

What You Can Work With 100 mW

Just to mention a few things that can be done with battery rigs, checking back down through the years I find the following: In Bermuda, operating Be-BER, on 80.5 meters, I always kept a 201A tube oscillator with B batteries ready as a standby and worked CW all up and down the East coast, New York being some 660 miles away.

Down East on the island in Penobscot Bay, Maine, 8 miles south of Belfast, in the 1930's, again with B batteries – this time on 160 meters which was a wonderful band in those days – I worked everybody around . . . Rockland, Belfast, Deer Island, Castine, etc., and also one fine morning, 1ZE on Cape Cod, all on phone.

In the 1960's with almost exactly 100 mW output on 6 meters and a plain dipole, on Mt. Monadnock in NH, three stations in and around Hartford, Connecticut, were worked. That's a good two hours drive in a car, even today.

Conclusion

There is no need to worry about whether or not you can build rigs at 432 MHz at low cost. The Motorola HEP56 for $1 and change will do everything you want up to 432 MHz. To get a little power there you need to go up a little in price, such as a KMC H104 at $5. That one is also good for 1296 MHz, however.

. . . K1CLL

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More Fun with the IC-230

Owners of the IC-230 seem to be very pleased with its operation. The ease of channel selection and switchable repeater offset certainly contribute to its popularity. However, a very simple modification will make it even more convenient to use.

The present method of selecting the positive or negative 600 kHz transmitter offset is a switch, S5, on the top panel of the transceiver. If the switch is placed in the "A" position, the transmitter frequency is shifted 600 kHz lower than the receiver frequency. The "B" position raises the transmitter frequency 600 kHz above the receiver frequency.

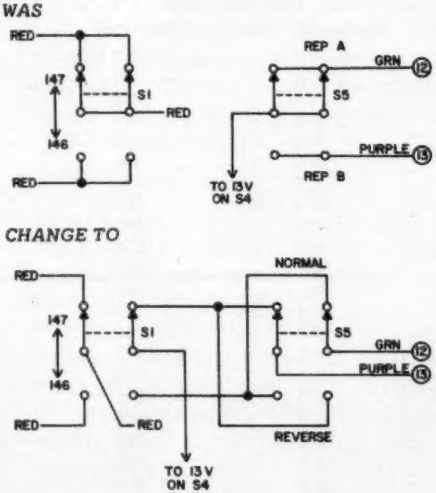

Fig. 1.

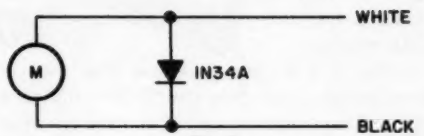

Fig. 2.

Another switch, S1, on the front panel, selects the 146 MHz or 147 MHz band. To properly switch from a repeater in the 146 MHz range to a repeater in the 147 MHz range, the operator must actuate both S5 and S1. An easy modification, shown in Fig. 1, will allow single switch operation. S5 is now wired for "Normal" and "Reverse" and, in the "Normal" position, the correct repeater offset will be automatically selected by S1. Reverse operation is still provided for by placing S5 in the "Reverse" position.

After using the IC-230 for a short time, it was noticed that the meter needle would bang hard against the stop every time a strong signal came on. To prevent this, a 1N34A germanium diode was shunted across the meter, as in Fig. 2. The result is a logarithmic compression of the high end of the meter. Local repeaters now indicate about 9 on the meter scale.

The accessory socket is a convenient place to attach a tone burst generator. Fig. 3 is a diagram of a simple unijunction circuit which provides the 0.5 second tone. The 25k pot is adjusted for the desired frequency with the 2N1595 disconnected.

Fig. 4 shows a novel audio amplifier which will raise the 1-2 Watt transceiver

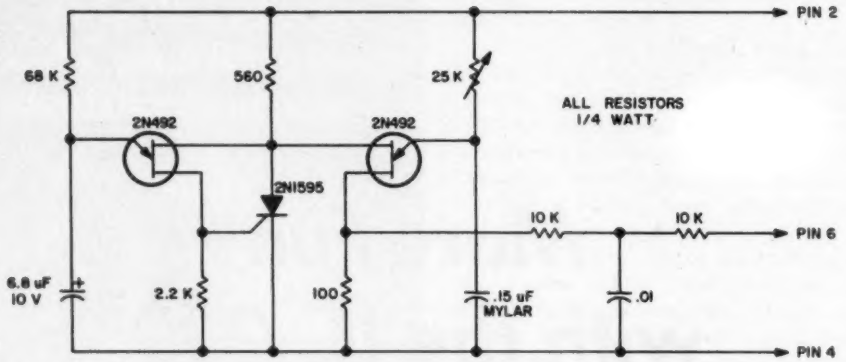

Fig. 3. Tone burst generator.

audio output to the 10-15 Watt range. An 8 Ohm speaker may be used but maximum audio output will only be achieved with a 4 Ohm speaker.

The IC-230 has provision for use on frequencies other than the 30 kHz standard steps. One additional crystal may be used with the CO oscillator and four crystals may be plugged into the LO oscillator. Some areas of the country have repeaters on the split frequencies between the standard channels and it seems likely that, as 2 meter activity increases, this trend will continue. It was therefore decided to get as many of these split channels as possible with the 5 added crystals.

If the following crystals are placed in the crystal holders indicated,

Frequency	Location
11.566 MHz	CO Socket C
13.821 MHz	LO Socket 8
13.858 MHz	LO Socket 9
13.894 MHz	LO Socket 10
13.931 MHz	LO Socket 11

then the following new channels result:

146 MHz Range

Switch Positions	Frequency
A 1	146.355 MHz
A 4	.385
A 7	.415
A 0	.445
A 3	.475
A 6	.505
A 9	.535
A 2	.565
A 5	.595
A 8	.625
A C	.655
B 1	.685
B 4	.715
B 7	.745
B 0	.775
B 3	.805
B 6	.835
B 9	.865
B 2	.895
B 5	.925
B 8	.955
B C	.985

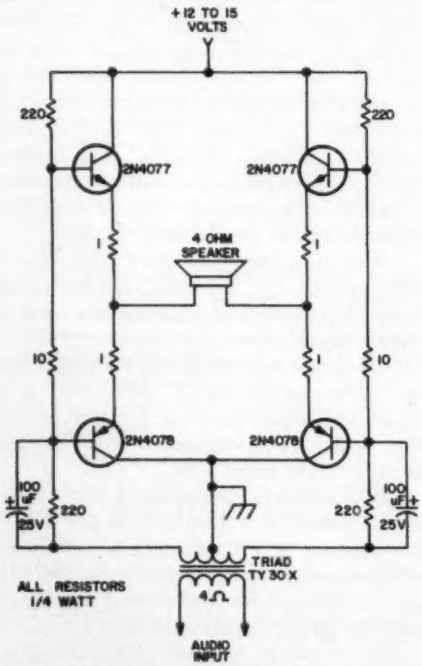

Fig. 4.

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147 MHz Range

Switch Positions	Frequency
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A 4	.045
A 7	.075
A 0	.105
A 3	.135
A 6	.165
A 9	.195
A 2	.225
A 5	.255
A 8	.285
A C	.315
B 1	.345
B 4	.375
B 7	.405
B 0	.435
B 3	.465
B 6	.495
B 9	.525
B 2	.555
B 5	.585
B 8	.615
B C	.645

The five added crystals allow simplex operation on all 15 kHz split channels between 146.355 MHz and 147.645 MHz. The positive or negative 600 kHz offset may be selected as described before for repeater operation.

. . . WA6VJR

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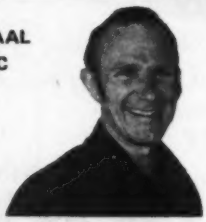
MIKE STAAL
K6MYC



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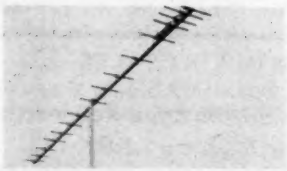

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D. H. Gieskieng W6NLB/7
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Does Ether Cause Gravity?

One of the most interesting results of the Palomar telescope has been its ability to reveal large clouds of interstellar gas and dust and to resolve individual galaxies. This in turn has shown them to be commonplace and from the numerous perspectives of these the gravitation-accretion evolutionary pattern of the formation of stars and other celestial bodies becomes somewhat evident.[1]

Not as evident is the carrier mechanism by which light and radio waves are transmitted with high efficiency through vast distances, even with frequencies as low as 30 Hertz from Pulsars.[2] Such a medium has been the subject of thought for years and tentatively named Ether or Aether.[3,6] It is thought to be field-like, has no mass and is thereby incapable of retaining oscillatory electromagnetic energy as heat.

Measurement of outerspace void temperature as Ether temperature is complicated by the presence of one or more gas molecules per cubic centimeter, and the problem of isolating the mass of the temperature measuring equipment from cosmic radiation warming.[4] The lack of mass, and hence specific heat capacity, is probably the most logical means of mathematically estimating Ether temperature at 0°K in space or between the closely packed atoms of objects. It could have a type of superconductivity because of that temperature, if not for some other reason.

The transmission of electromagnetic waves might be by a mechanism of such superconductivity and auto- or self-induction. In this case the very small residual from the Ether/Semimaterialistic/Ether traveling wave transition in the $E = Mc^2$ (energy, mass, speed of light) relationship probably appears mostly as harmonic and other forms of radiation.

Alternately, or in combination, is the conception of Ether being a vast neutral magnetic field, and that magnetism as we generally regard it is a local polarization of Ether. In this event, physical devices such as current carrying wires and permanent magnets are in part probably exhibiting the result of the polarization of the Ether around the parts of their atoms, with the combined field of the atoms and internal Ether equalizing itself by an external return path through the Ether external to the object. With a medium such as Ether as a common interspace property, the generation and transmission of magnetic waves from the transmitting to receiving antennas is more readily understood.

The scope of this phenomenon would seem to include the radiation of very low average power level waves, but probably quantum pulse type, generated by the molecule to molecule chemical chain reaction method employed to pass a signal through a nerve duct. Reception of these waves in corresponding second person ducts

---

[1] *The Birth of Stars*, Bart J. Bok, Scientific American, Aug., 1972.

[2] *Rotation in High Energy Astrophysics*, Franco Pacini and Martin J. Rees, Scientific American, Feb., 1973.

[3] *Encyclopedia Britannica.*

[4] *Deuterium in the Universe*, Jay M. Pasachoff and William A. Fowler, Scientific American, May, 1974.

inherently incorporates the advantages of extreme sensitivity and wave shape, pulse code or frequency selectivity, each molecule in the nerve channel being a natural delicately balanced equivalent of a regenerative filter. Besides ESP between fauna, such transmission apparently includes flora, as in the Backster Effect.[5]

The Gravity Premise

Ether uniformly permeates space and the Earth, as well as a dust particle or atom, with the exceptions of the actual space occupied by parts of the atom. These exceptions would cause a minute, but accumulatively significant anomaly in the Ether field, the strain being very nearly proportional to the mass of the object. If it is visualized that each object involves such a symmetrical, possibly internally polarized anomaly, and that these anomalies tend to coalesce, the conditions of the well known gravity force equation are approximated:

$$F = G \frac{M1 \times M2}{d^2} ,$$

where G is the gravitational constant, M the mass of each body, and d the distance between the bodies.

As to these anomalies being a condition of deficiency by exclusion of bits of Ether field by displacement by the parts of the atoms, or one of enhancement due to the parts possibly having derived from Ether and being bits of highly concentrated Ether, would seem to provide an area of exploration and possibly assist in the further identification of the source of matter. Involvement of each object by an Ether strain anomaly in the broad sense would seem to fit such gravity observations as the fall of Newton's apple, the effect of the moon on tides on the opposite side of the earth, as well as outerspace relationships concerning the accretion of dust and gases with increasing gravity, density, temperature and solar activity.

There appears to be no difference in the weight or mass of a magnet bar magnetized or unmagnetized. Even when magnetized, the infinitesimal size of the magnet as compared to the earth or its magnetic field causes essentially equal exposure of its two poles to the earth and cancellation of any attraction-weight effect. Where the size of so-called "non-magnetic" material pieces are smaller than the magnet, some fine differences have been found and utilized for ore concentration purposes.

The relative size effect is perhaps best illustrated by two magnets and their mutual attraction or repulsion, since their poles are distinct to each other and can considerably modify the mutual gravitation force equation when brought into proximity.

While light and radio waves probably involve an extremely small loss in the Ether/Semimaterialistic/Ether traveling transition and accordingly dissipate with distance on this account, gravity in the form of a constant Ether strain would, because of its very gradual accumulation, be stabilized and proceed with its body as an entity in the aspects of relativity.

Summary

Many of the remaining subatomic identities are yielding to predictive analysis based on the equations of relativity, including new versions of an Ether such as that of Dirac, as well as explanation of the Michelson and Morley experiment.[6] While Ether would appear to be the zero energy condition in the absence of mass in Einstein's equation, $E = M c^2$, the dynamic energy of the passage of electromagnetic waves through it, or the static strain of gravity, represent very small excursions of Ether above the zero level. The energy input required to go on to the materialization of stable atomic structure is extremely more than these modest levels, requiring the accumulations evident in the sun and other stellar bodies.

Additional Reference

To Know What We Are, Fred C. Bond, Exposition Press, 1972.

... W6NLB/7

[5] *Evidence of a Primary Perception in Plant Life,* Cleve Backster, International Journal of Parapsychology, 10:4, Winter, 1968.

[6] *The New Age in Physics,* Sir Harrie Massey, 1968.

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The Violet Tester

Even though you build and design complex pieces of electronic equipment that shock others in the world of electronics, the average XYL generally has no idea what you have created. She usually thinks in terms of dollars spent, and time you have expended hiding in the basement, building a "Magic Box." Yet, even though not understanding what you have done, she always seems to come up with ego building statements such as "Isn't that wonderful!" etc. Isn't it therefore about time that we create a device that the XYL can understand, is useful, and costs only a *few* dollars? This certainly would provide you with the true recognition you so desire – that of an electronic super genius.

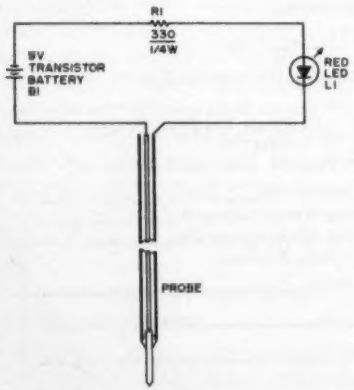

Fig. 1. Violet tester schematic.

The device we are about to describe might be classified as a "one evening kit" and does just as the title says – it tests violets. (Violets are those little plants that grow in the living room window with fuzzy leaves and purple blossoms.) Not only does it test violets, but other miscellaneous house plants as well. This gadget detects the presence (or absence) of moisture and informs the XYL when it is time to water her plants.

The violet tester does not require exotic memory ICs, clock chips or printed circuit boards. One LED (garden variety), a single 330 Ohm resistor and a 9 volt transistor radio battery are all the parts needed for the "heart" of the device. The testing probe, case, etc., may be constructed of miscellaneous junk that you have accumulated.

If you will notice Fig. 1, the 9 volt transistor radio battery is in series with the 330 Ohm resistor and LED indicator. The 330 Ohm resistor limits the current to the LED. Without the current limiting resistor, the LED would draw excess current and soon destroy itself. Also in series with the above are test probes. These probes, when inserted in the soil, will provide a current flow or complete the series circuit if moisture is present. The amount of moisture and mineral content of the soil will determine the current available to light the LED. Therefore, when adequate moisture is present, the LED will come up to near full

brilliance. Varying lesser degrees of illumination will indicate less moisture.

At this point may we indicate that the "violet tester" is not a laboratory standard – it is merely a gadget to indicate relative moisture, and at that, serves its function well. What we are trying to say is – if some plant suddenly shrivels up, it is not the fault of the violet tester. On the other hand, if the vegetation involved suddenly tries to molest you some evening due to its fantastic state of health, it also is not the fault of the tester.

Anyway the device has proved to be much more sensitive than we had expected prior to construction. Common LEDs seem to be very responsive to minute current changes.

The moisture probe does not have to be a single chunk of copper tubing such as we have used. A pair of separate probes spaced 1" will work equally as well. The only requirement is that they be rigid enough to penetrate the soil.

Fig. 2 illustrates construction of the violet tester. We used a small chunk of 1-7/8" plastic water pipe to enclose the main circuitry. The top and bottom plates are made from scrap 1/8" plastic. The top section (containing the LED) is cemented in place with epoxy. The bottom plate is held in place with 4-40 bolts. This allows the bottom to be removed for battery replacement. The 3/16" copper tubing probe must be made secure in the bottom plastic plate as it will take quite a bit of stress when being inserted in the soil. A hole is drilled at the center of the plastic bottom plate just a bit larger than the 3/16" copper tube. A washer is then soldered about ½" down on the tubing. After inserting the tubing through the hole, the washer will limit its travel. Split the tubing that protrudes through the hole with a hacksaw and fold down the halves flush with the bottom plate. Epoxy cement the "fold overs" to the plastic bottom. The washer acts as the stress point.

Grind a piece of #14 copper wire to a point and then solder a good length of insulated hookup wire to the non-pointed end. This assembly is then epoxied inside the 3/16" tubing. A small piece of masking tape wrapped around the center probe will hold it in place while the epoxy dries.

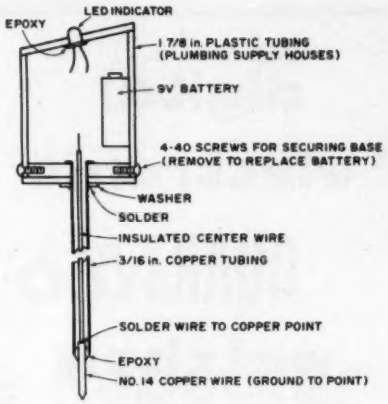

Fig. 2. Violet tester basic construction.

The LED indicator is also held in place in the upper plate with epoxy glue. After the glue has set, the wiring is completed. Use a battery clip for easy replacement of the 9 V battery when necessary.

Just about everything in this device is non-critical yet good results may be expected. The layout and case may be just about anything that is convenient.

Not only may the "violet tester" be used for plants, but it should serve well as a lawn, rose bush, or garden tester. By attaching clip leads and a remote probe, it would tell you when your basement is flooding. It makes a good continuity tester also. Just think – if some clever individuals were to mass produce this gadget, it would probably sell for $5.99 at local discount stores. Therefore, before this happens, you can be the "first on your block" with a "violet tester."

After completing this "one evening kit" you might really have fun with the XYL by telling her it is a tester for the presence of coffee in a cup. If the tester is inserted in a cup of coffee it will indicate with full brilliance. With that, she will know for certain that you are completely "off your rocker" and really do need complete rest for six months in the Bahamas.

We wish to thank our XYL Marie for typing this article and for "proof testing" the violet tester.

. . . W2AOO

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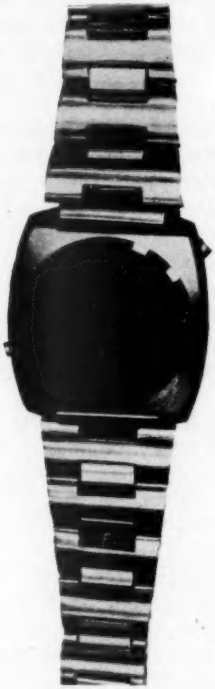

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The TT-63A Regenerative Repeater

Some time ago, after becoming interested in amateur radio Teletype, I became the owner of a TT-63A, which I wanted to use as a Teletype converter. After much letter writing and digging through stacks of technical manuals, I came up with the following information.

Basically, the TT-63A is a Regenerative Teletypewriter Repeater used with Teletype Repeater Set AN/FGC-7A. It is capable of accepting RTTY signals in audio (On-Off) or Direct Current (Polar-Neutral) form having up to 45% bias distortion and regenerating the signal to have less than 5% bias distortion at the output. The input keying tone range is 500 to 3600 Hertz per second at 30 milliamps for Polar and 60 milliamps for Neutral keying output. The dc keying must be negative with respect to ground on Mark, and the tone keying may be either normal or inverse. The unit has its own built-in power supply for the voltage necessary for the operation of the repeater unit itself, and requires either 105-125 V ac or 210-230 V ac at 50-60 Hertz. On 115 V ac, the unit draws about 85 Watts of current. The TT-63A is intended to perform two general functions. The first is to regenerate single-channel RTTY signals before operation of a printer. The second is to regenerate diplex RTTY signals to single channel form for the operation of the printer.

Some of the characteristics of the TT-63A are as follows: (1) If there is a missing start pulse due to fading on the signal, the repeater will be started by a following pulse of approximately 10 milliseconds, and will print errors for a few characters until it has corrected itself; (2) If the start pulse is too short in duration (less than 10 milliseconds) at 60 wpm operation, it is treated as noise and intercepted so that a following pulse of longer duration than the 10 millisecond start pulse will act as the start pulse. Again, the errors will be printed for a few characters until the unit has corrected itself; (3) If there is a missing intelligence pulse or if there is a split or knockout of the intelligence pulse at the point where sampling occurs, an error will be printed.

To put the TT-63A into operation, a power supply capable of operating the keying mechanism (Local Loop Supply) of the Teletypewriters must be connected in series with the output of the repeater. It is recommended that shielded two-conductor cable be used for the line connections, to reduce random noise to a minimum. For neutral or polar dc inputs, the side of the line connected to the negative terminal board connector must be negative during the Mark signal. The positive neutral input connection to the repeater is ground. The positive Polar input connection is 620 Ohms to ground as is the negative Polar terminal.

This provides for polar inputs that are balanced in respect to ground. The tone input to the repeater is normally 600 Ohms balanced to ground, but by grounding one of the tone input terminals, an unbalanced tone input may be used.

To operate the unit, allow fifteen minutes for warm-up after the repeater is turned on. Inside the access door on the front panel make the following settings of the controls:

Turn the Normal-Reverse switch to the Reverse position. The neon lamp should go off. Return the switch to the Normal position and the neon lamp should be lit again. This check shows that the repeater is powered and that the Trigger circuit is operating. Next, set the Speed switch to the range desired for the operating speed of the Teletype equipment. The next step is to set the switches inside the access door to coincide with the input fed to the TT-63A. The Tone-Dc switch is set to the "Tone" position if using an audio type of input signal. The Neutral-Tone-Polar-Diplex Tone switch is set to the Neutral-Tone position, and the Normal-Mark-hold switch set to the Normal position for print upon a received signal. In the Mark-hold position the output is a constant MARK signal and in most cases will keep the machine from printing even with an input signal. Next, apply a signal to the repeater. The neon lamp should blink when the signal is applied. If the lamp does not blink, advance the Input Attenuator clockwise until a point is reached where the lamp does blink. This is called the Trigger point. Now advance the Input Attenuator control another six steps (6 dB) beyond the Trigger point. If the attenuator control reaches "0" before six steps can be made, set the control to "0." Set the Range control to "50." The Teletypewriter printer should start printing. If there is some distance between the main printer and the repeater, a monitor page printer can be plugged into the Monitor jack. Finally, slowly rotate the Range control of the repeater from "0" to "100." If the Teletypewriter begins printing errors or garbling at any point within the tuning range of the range control, set the control to halfway between the settings in which the errors began. For example, if

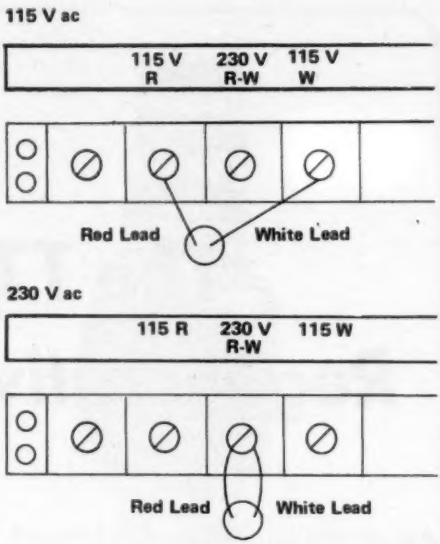


Fig. 1.

while tuning up from "0" the printer started printing garble at 80 on the range control, then set the control at 40. If errors or garbling begins with the control set at "0", check the speed setting on the Speed control inside the access panel.

For operation from 220 V ac, make the following changes on the terminal board on the rear of the repeater chassis. Remove the red lead connected to the 115 V R terminal and connect to the 230 V R-W terminal. Remove the white lead connected to the 115 V W terminal and connect it to the 230 V R-W terminal. The set is now ready to operate on 220 to 230 volts ac. For complete operation and maintenance instructions, a copy of Army Technical Manual TM 11-2247 should be acquired.

These units have been readily available from the surplus houses for as little as fifteen dollars, and manuals may be obtained from Sam Consalve W3IHD. The TT-63A is an inexpensive way to get started on radio Teletype, and when the final converter is acquired or built, the TT-63A can be added to the other converters as a simple linear discriminator with axis restorer ahead of the better converters with very little modification.

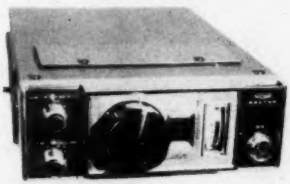
... WB4APC/DL5KS

ANNOUNCING

BELTEK W 5570

ICOM 230

ICOM 21



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Oscaring Your FM Rig

You can work DX on 2m via Oscar.

Oscar 7 is now in orbit, and Oscar 6 is still going great, too. Both of these satellites have a two meter to ten meter translator flying aboard and it's quite exciting to hear your own signal coming back via the satellite. If you haven't ever listened to the downlink signals, you'll find them between 29.400 MHz and 29.550 MHz (Oscar 6 – 29.450-29.550; Oscar 7 – 29.400-29.500). Copy the broadcasts from W1AW, or write to AMSAT for a schedule so you will know when to listen.

Once you hear the satellites, more than likely you will want to communicate through them. You will need some type of CW or SSB transmitter capable of operating on two meters. You say you don't have a two meter CW/SSB transmitter – well, don't skip to the next magazine article yet! Chances are you have some type of FM rig. With just a slight modification you can put it on CW. My rig is a Standard SR-C826m, ten Watts solid state. Although the specifics in this article are for the 826m, the ideas should be easily adaptable to many of the rigs on the current market.

First, you will need to get a crystal that will put you in the passband of the satellites. The input frequency passband for Oscar 6 is 145.900 MHz to 146.000 MHz. Oscar 7's input runs from 145.850 MHz to 145.950 MHz. As you can see, the passbands overlap by 50 kHz. So, if you get a crystal, say on 145.925 MHz, you could work through both satellites with just one rock. Via Oscar's translator, your downlink frequency would be 29.475 MHz plus or minus Doppler shift (and some conversion error on Oscar 6).

Now that you have selected a frequency and have installed the crystal in the radio, how do you go about keying the rig? The simplest way is keying the PTT lead. However, this has several drawbacks. Number one, you will wear out the relay contacts, especially if you are a high speed CW op. Secondly, your signal will no doubt have a chirp because you will be keying the oscillator on and off. So what is needed is a way to allow the oscillator to run continuously to eliminate the chirp, and a way to key the transmitter without chattering the relay. Here's how I did it with my Standard 826m:

To eliminate relay chatter and chirp, the PTT lead is shorted to ground. This transfers the antenna to the transmitter output and turns on the oscillator. Of course, with no modifications made as yet, the transmitter output is present also. Now to eliminate that except when it is desired, i.e. when the key is down.

Looking at the diagram of the transmitter swr shutdown circuit, note that Q340 is normally biased on by R327. This completes the emitter circuit of Q336, the pre-driver transistor in the transmitter. An excessive

swr develops positive voltage at the base of Q341 which turns Q341 on, in turn clamping the base of Q340 which turns it off and opens the emitter circuit of Q336. Hence, no output. Now, if we control this circuitry with a telegraph key, we will have accomplished our second goal. It can be done two ways, at least.

One way (Mod. 1) is to break the emitter lead of Q340 and key it to ground. Use a bypass from the emitter to ground. A .01 uF will do. Without the bypass, the keying lead acts as a choke and may cause problems. I have modified three rigs this way. Two worked just fine. The third was a bit squirrelly. The output was not as much with the key in the circuit as it was before the modification. So I came up with the second arrangement. Although the first way is the simplest, I prefer the second because it does not modify the rf path of the original circuitry.

The second way (Mod. 2) is to break the lead from R327 to +12 volts. This removes the bias from Q340 and turns it off, thereby cutting off the transmitter. Connect the key between +12 volts and R327. Key down, Q340 turns on and transmitter output returns. It keys clean and there is no problem with rf. Strictly dc keying.

The only modification required to the radio is to cut the paths on the circuit board to isolate either the emitter of Q340 or the high side of R327, depending on which modification you are going to use. Then run a wire from the isolated lead to pin 3 on the RT jack on the back panel of the radio. (Pin 3 is normally unused as it comes from the factory.) If you are keying the emitter of Q340 to ground (Mod. 1), the key goes between pins 1 and 3 of the RT jack, with the PTT shorting jumper between pins 1 and 5. If you are keying +12 volts to R327 (Mod. 2), the key goes between pins 3 and 8 of the RT jack. The PTT jumper is also required (1 to 5). Note: There are +12 volts on pin 8 of the RT jack as long as the radio is connected to the power supply. Turning the On/Vol control switch off does *not* remove this voltage. Use necessary precautions.

I wired two plugs for my radio. One simply has a short across the two pins where

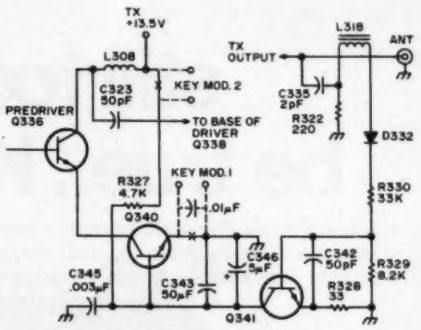

Fig. 1. Swr shutdown circuit. All transistors are NPN.

the key is connected. When this plug is installed in the RT jack, the radio is returned to normal FM operation. The other plug has the PTT jumper and the two wires going to the telegraph key. When it is inserted in the RT jack, the relay keys, supplying voltage to the exciter. Press the key and you are on the air. With the ten Watts and a 10 dB gain antenna system, you've got 100 Watts erp of CW ready for Oscar. If you want, you can drive an amplifier with the rig to get a little more punch. (Ten Watts drives the pants off of a pair of 4X150's. 300 Watts output!) By the way, be sure to disconnect your microphone or you'll have keyed FM instead of CW.

I used this system on Oscar 6 and successfully completed hundreds of QSO's – nearly 40 states and four continents including F9, G3, GM3, VP9, 8P6, PJ7, PJ9, KL7, and KH6 – all in just a few months. Floyd W4GSH has used an 826m keyed this way to drive a tripler to 432 MHz and has made many contacts via Oscar 7's 432 MHz to 144 MHz translator.

After you get your initial setup, you will want to build a VXO so you're not rock-bound to one frequency. But at least now you know one way to get started. It's not a difficult modification and it doesn't deface the rig in any way.

Satellite communication is one of the newest challenges to the modern amateur. With this simple approach, for the price of a crystal and an hour's labor, you can meet that challenge. Besides, it just might prove to be fun!

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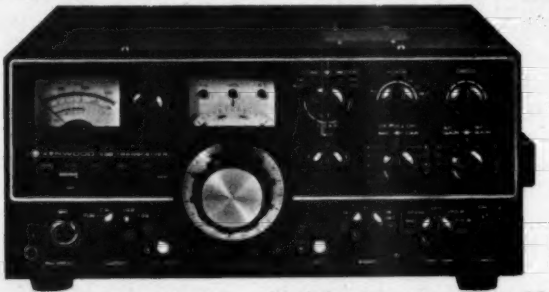

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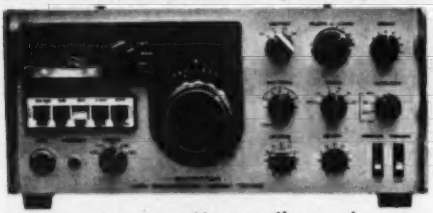

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Basic Telephone Systems Part Two

Spenser Whipple, Jr.
c/o 73 Magazine
Peterborough NH 03458

Inside Ma Bell

In several areas, the telephone companies have recently started to check customers' lines for extra extensions not rented from them. When a phone is on-hook, a series circuit consisting of the ringer and a 0.5 μF capacitor is still connected across the phone line. Using fairly simple equipment, this load can be sensed and measured. When a dc voltage is first connected to a capacitor, a current flows through it until it has a chance to charge up to the applied voltage. For example, if you connect an ohmmeter set to a high Ohms range to a capacitor, the meter will swing up and then slowly drift back down. Some meters (such as the Simpson 260) have a polarity reversal switch, which changes the applied voltage's polarity as you flip the switch. Connect that to a phone, and each time you flip the switch, the 0.5 μF capacitor will charge and cause a momentary swing up of the meter needle. The distance that it swings is an indication of the capacity, or in the case of phones, of the number of telephone bells connected in parallel.

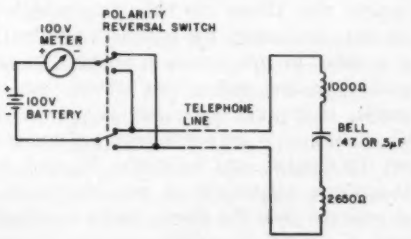

Fig. 6. Test circuit for detecting the presence of extra bells.

It appears that a circuit similar to that of Fig. 6 is actually used by telephone company personnel in checking the line capacitance. Each time the reversal switch is flipped, the voltmeter shows a brief burst of current going into the line to charge the bell capacitor. How high up the meter swings and how long it stays there indicates the capacity. While it may be difficult to get an accurate reading from the CO, since there may be thousands of feet of wire between the telephone and the CO, it is an easy matter to send a telephone installer to the basement of the customer's apartment house, or to climb a pole near the customer's house, if a suspicious reading is obtained.

There are a number of well-known techniques used by people to avoid such problems. The obvious solution is to simply disconnect the ringer in any extra telephones. In cases where an extra bell might be convenient, a circuit such as that on page 31 of the April 1974 issue of 73 Magazine could possibly be used to ring as many conventional bells as one might want. There are people, of course, who take simpler steps. One popular technique is to disconnect all ringers, and instead substitute a relay circuit whose impedance is close to that of the company-installed ringer; the relay can then be used to ring any bells you need. A circuit such as the one in Fig. 7 might work; the total resistance is close to the 3650 Ohms and the capacitance is close to the 0.5 μF actually used, so this circuit should look just like your normal telephone bell. (For $2.15 per month, the New York Telephone Company will rent you a ringing relay that

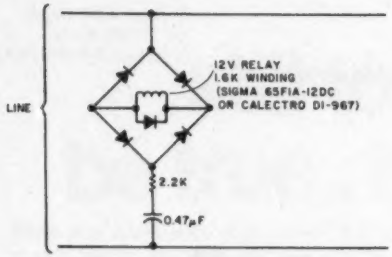

Fig. 7. Substitute bell circuit.

does just this.) I have heard of yet another solution, though it too is against tariffs and hence not recommended. It consists of replacing the 0.5 μF capacitors in each of two phones with 0.25 μF, which makes the bells ring slightly softer than before, but does not change the total capacitance. The series resistance and inductance change, of course, and so this is an intriguing solution but not a technically foolproof one.

There are only two solutions which will satisfy the phone company's desires – either use a "wireless" technique of coupling to the phone – inductively or acoustically – or rent a wired coupler directly from the phone company. Despite the fact that wired couplers are simple and could be built by any one of a thousand little electronics companies, the telephone companies claim that only they are technically advanced enough to build and install them, and so you have no other choice but to pay their exorbitant rates.

I don't know about the tariffs in other states, but the New York Telephone Company tariff (which is filed with the state's Public Service Commission and available for inspection at any telephone company business office as well as many libraries) specifically states that any acoustic or inductive connection to its equipment is OK as long as it is done outside the telephone company equipment, and as long as any signal fed back into the telephone line is below specified levels. These levels are specified in the New York tariff as follows:

> "... to prevent excessive noise and cross-talk in the network, it is necessary that the power of the signal at the input to the line not exceed 9 decibels below one milliwatt when averaged over any 3-second interval."

The one exception to the -9 dBm requirement is that if you have a Teletype machine and use acoustic or inductive coupling of the Teletype tones into the line, the company may authorize a level up to 0 dBm at your end of the line as long as the power at the CO does not exceed -12 dBm. (With direct connection using a coupler, the wording is a little different, specifying only that the power of the signal at the central office must not exceed 12 dB below 1 milliwatt over any 3-second interval.) Moreover, the power in the range from 3995 to 4005 Hz must be 18 dB below the maximum level specified above, which is probably designed to protect its long distance services, which use a 4 kHz carrier spacing.

Additional level limits are as follows:

Maximum power in 4 to 10 kHz range is -16 dBm;

Maximum power in 10 to 25 kHz range is -24 dBm;

Maximum power in 25 to 40 kHz range is -36 dBm;

Maximum power in above 40 kHz range is -50 dBm.

Finally, it is not allowed to have any energy solely in the range from 2450 to 2750 Hz, and the total power of any signals in the range from 2450 to 2750 Hz must be less than the power of any signals in the 800 to 2450 Hz range at the same time. The purpose of this prohibition is to avoid interference with a very interesting signalling tone at 2600 Hz. More on this later.

Acoustic couplers are commonly used with computer equipment. Such a coupler consists of a cradle into which the phone handset fits. Under the handset's mike is a speaker, and under the handset's earphone, is a mike. In this way it is possible to get audio into and out of the phone, but of course, it requires somebody human to do the dialing or to answer a ringing phone and put the handset into the cradle. If you have Touchtone service, it is possible to dial acoustically into the phone, but a very high level is needed to achieve reliable dialing, and sometimes it's hard to pump that much energy into the phone's microphone without

getting a lot of distortion. As to answering the phone, you could build some sort of solenoid which would push down and release the hookswitch on the telephone. If the solenoid were fast enough, you might even be able to use it to dial by rapidly pulsing the hookswitch up and down the required number of times. Finally, detecting a ring could be done with the same microphone which picks the audio out of the handset. As you can see, this whole arrangement can become a Rube Goldberg monster of mechanical construction. There is a slightly easier way out of it, and that is to get the cradle which is used with the Crown telephone answering machines. It has the required acoustic coupler; it has a solenoid which can push the hookswitch plunger up and down; and it even has a second mike to sense the telephone ring.

Inductive methods are also allowed. For instance, most electronics stores sell an inductive pickup which can be placed near the handset or near the hybrid network and will pick up enough audio out of the phone. But getting enough audio back into the phone inductively requires a lot of patient work, and I suspect it would be awfully hard.

And that brings us back to the phone company's own couplers. As mentioned before, telephone companies generally require that such a coupler, which they suggestively call a protective coupler to pretty up the idea, must be rented from and installed by them. This is roughly analogous to your local electric company's claim that only they are smart enough to make and install toasters and light bulbs, and that you must rent all your house appliances from them at prices far above and beyond the going rates.

The funny thing is that even though the couplers are such obvious moneymakers in themselves, the phone companies make you feel as though they are doing you a favor when you want one. It's obvious that renting extensions and extra jacks and bells and fancy bedroom phones must be good business, or they wouldn't work so hard to keep the competition from muscling in.

My own experience confirmed what others told me – be prepared to do a lot of

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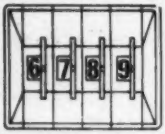

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waiting and explaining. Before talking to me, the Business Office wanted to know my whole life history – where I lived, what my phone number was, what I wanted to connect, etc. It's like the gas company asking whether the gas they were selling me was for making coffee or baking a cake. Then they told me they had no information, but a salesman would call me. Their salesmen have unlisted numbers, so it's "don't call us, we'll call you." When they finally call, it's always the wrong fella – no, that's not his specialty, but someone else will call by and by. No, they have no catalogs; no technical literature either. Sorry, but the information is not available. Can't tell you what we have available – you tell us what you need, and we'll quote you a price. Yes, you can get on a mailing list if you call 195 Broadway. Sorry, but information doesn't have the phone numbers for Telephone Company offices; perhaps 330 Madison Avenue can help? At 330 Madison Avenue, the operator doesn't know what you are talking about. Perhaps some big Cheese's secretary can help. How did you get this number, sir – subscribers are not supposed to call this number! Sorry, no technical information is available. Humbug!!! No wonder there are hundreds, perhaps thousands, of phone phreaks around the country whose sole aim in life is to screw the Phone Company.

The first step in getting information on any of these couplers is to visit either your local Business Office or a big branch of the library, and ask to see the telephone company tariffs. Don't be surprised if the Business Office personnel get all flustered when you ask to see the book – you have every right to see it. In my case the receptionist asked whether I was planning to use the tariffs to sue them, while the office manager gave me a pep talk on how the telephone company is being robbed by interconnection companies of the "cream of the business" and is suffering under unfair competition.

While the rates from your own telephone company are undoubtedly different, you may be interested in some of the information we gleaned from our local tariff book.

First, if you go out and buy your own

telephone, you must contact the local telephone company to have them convert and install it. If the telephone housing is stamped as being approved by the company as being compatible with their equipment, then they will tear out the guts and install a ringer and network, a new dial, new microphone and earphone, and some cabling. For this they will charge you $15.64 conversion fee, $13 installation, and $1.35 monthly charge which they get for an extension telephone.

If the housing is not stamped that it is approved, then you get the same service but the installation charge goes to $39.11, unless the housing is such that their parts don't fit into it, in which case they just won't do it. Now, if you buy a Western Electric phone just like the one used by the local phone company, it will probably not be stamped as being approved. That means they tear everything out, put in new parts (or maybe even the same old parts?), and charge you the $39 and change. Plus $1.35 a month. Oh yes, on top of everything else, you still have to pay the $13 charge for having an extension put in.

Unless you have a priceless vase from the Ming Dynasty that you desperately want converted into a phone, it obviously doesn't pay to let the phone company touch it. Even then, whether you'd want them to touch a priceless vase is questionable anyway.

The other way to get a fancy telephone is to order one from the phone company. For a price ranging from $56 to $110 you can order a "Design Line" phone which they will then happily install for $13 and charge you $1.35 for every month. If you don't want a gold-painted phone, a plain black one is just the $13 and a monthly charge. For an extra charge you can get colors, etc.

The gist of all this is that any way you look at it, you can't get away from the basic $13 installation fee and the $1.35 a month, regardless of whether you use your phone or theirs, so you might as well settle for theirs.

On the other hand, there are some fascinating gadgets which might be of interest to you after all. For instance, suppose you want to hook up 10 extension phones in your house. For only $5.35 a month and no installation fee, you can get a CD8 coupler which is designed for privately owned switchboards. Throw together a few relays to make a "switchboard" and you can connect all 10 of your own phones to this one coupler, in accordance with the tariffs, and without having a guilty conscience disturb your sleep. Let's look at a few of the couplers available and what they can and can't do. Our discussion will center on Western Electric couplers available through Bell System telephone companies, but similar units are available from other telephone companies as well. The prices mentioned are those charged by the New York (Bell) Telephone Company, and other telephone companies may charge more or less

The simplest coupler is the 30-type device shown in Fig. 8. As with other couplers, this unit is referred to by its USOC – Uniform Service Ordering Code – which is QKT or QKTBT. These couplers cost $0.72 a month plus an installation fee of $28.94.

As shown in Fig. 8, the coupler consists of just a few parts. The matching trans-

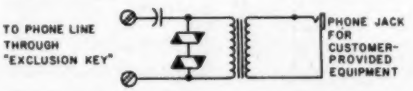

Fig. 8. The simplest protective coupler – the 30-type or F57948(MD). (The 30-type doesn't have the screw terminals.)

former has a 600 Ohm impedance at the phone jack, and can be used both for transmission and for reception. It provides dc isolation from the phone line and also prevents accidental grounding of the line. The two varistors in series limit the maximum audio signal level that can be fed back to the line. Finally, because of the series capacitor, the coupler does not complete the dc circuit through the phone line. It must always be used in combination with a telephone-company-supplied telephone set which is used to place and answer calls, and which completes the dc circuit during the call. To prevent the 20 Hz ringing voltage from being applied to the coupler, the coupler is wired through the associated telephone set so that it is connected to the line only when the telephone set is off-hook and a separate switch called the "exclusion key" is operated. (At your option, you may have the exclusion key wired so that when the coupler is connected, the telephone set

mike and/or earphone is disabled.) Hence, this coupler is for strictly manual use – you have to manually operate the telephone hookswitch and exclusion key. Thus this coupler could be easily used with your phone patch on sideband, but would be useless for a repeater autopatch or automatic answering machine. If you didn't mind the extra work of operating the main telephone set, you could hook up any number of your own extensions as shown in Fig. 9. But these extensions could only be used to talk and listen through – they would not ring, and you could not use their rotary dials nor could you start or end a call from them, since only the telephone-company-supplied phone controls the connection.

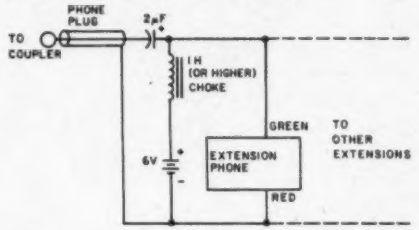

Fig. 9. Connecting extension phones to a 30-type coupler. The 6-volt battery supplies talk current to the extension's carbon microphone only when an extension is off-hook.

If you have Touchtone service, then a Touchtone extension may be used to provide dialing if you get the right coupler. The QKT Voice Connecting Arrangement (which uses a 30A coupler) has varistors which clip at a lower signal level than those of the QKTBT, which uses the 30B coupler. As a result the QKTBT is needed for reliable Touchtone dialing as the QKT may not let through enough signal.

This may be a good place to look at Touchtone dialing requirements. The frequency tolerance of the tones is ±1.5%. Any other frequencies present during dialing (such as harmonics or intermod) should be at least 20 dB below the Touchtone tone power. Any voice signal should be at least 45 dB below. Each of the two tones should rise to at least 90% of full level within 3-5 milliseconds and should not overshoot by more than 12 dB. The minimum tone-on time is 50 milliseconds, the minimum tone-off time between digits is 45 milliseconds, and the maximum dialing speed is 100 milliseconds per digit.

As for Touchtone level, we mentioned earlier that the maximum power allowed into the system with a direct coupler is such that the power measured on your line at the CO does not exceed -12 dBm when averaged over any 3-second interval. To translate this into power *into the coupler* we need to know the loss in the landline between the coupler and the CO. This loss may be anywhere from 0 to 10 dB. The figure usually used by the telephone company as an average is 3 dB. It is fairly easy to measure (if you know how), since there is a number you can call which returns 1000 Hz at 0 dBm (measured at the CO) back to you. Measure the level at your end of the line and you can calculate the loss. In fact, if you get a computer data coupler (rather than a voice coupler) the phone company will measure it for you!

Assuming 3 dB as an average, that means you can feed -9 dBm into the line at your end. Since the coupler loss is about 2 dB, you can then feed -7 dBm *averaged over 3 seconds* into the coupler. But this is only an average power – if you dial with a duty factor of 25% (25% on, 75% off) you can raise your tone-on power by a factor of 4 (which is an extra 6 dB) to -1 dBm while still keeping the average power at -7 dBm.

But of course, you have two tones whose powers add, so each tone should be 3 dB lower. This works out to about -4 dBm for each tone going into the coupler.

The above calculations are for an average case only. To ensure correct detection by the CO, the phone company recommends the following limits into the coupler:
Nominal power for each tone: -4 to -6 dBm;
Minimum low-tone power: -10 dBm;
Minimum high-tone power: -8 dBm;
Maximum two-tone power: +2 dBm;
Maximum difference between the high tone and the low tone: 4 dB.

Anyhow, the QKT coupler will generally limit (or distort) Touchtone tones below a suitable level, and the QKTBT is designed to pass tones at a high enough level.

The CDT coupler is functionally similar to the QKT coupler, but is designed for data

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7. Regency HR-2B
8. S.B.E.
9. Standard

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1. 6.01T	8. 6.70R	15. 6.175T	22. 6.85R	29. 6.37T	36. 7.60T	43. 7.12R	50. 7.84T
2. 6.61R	9. 6.13T	16. 6.775R	23. 6.28T	30. 6.97R	37. 7.00R	44. 7.75T	51. 7.24R
3. 6.04T	10. 6.73R	17. 6.19T	24. 6.88R	31. 6.39T	38. 7.66T	45. 7.15R	52. 7.90T
4. 6.64R	11. 6.145T	18. 6.79R	25. 6.31T	32. 6.99R	39. 7.06R	46. 7.78T	53. 7.30R
5. 6.07T	12. 6.745R	19. 6.22T	26. 6.91R	33. 6.52T	40. 7.69T	47. 7.18R	54. 7.93T
6. 6.67R	13. 6.16T	20. 6.82R	27. 6.34T	34. 6.52R	41. 7.09R	48. 7.81T	55. 7.33R
7. 6.10T	14. 6.76R	21. 6.25T	28. 6.94R	35. 6.94T	42. 7.72T	49. 7.21R	56. 7.96T
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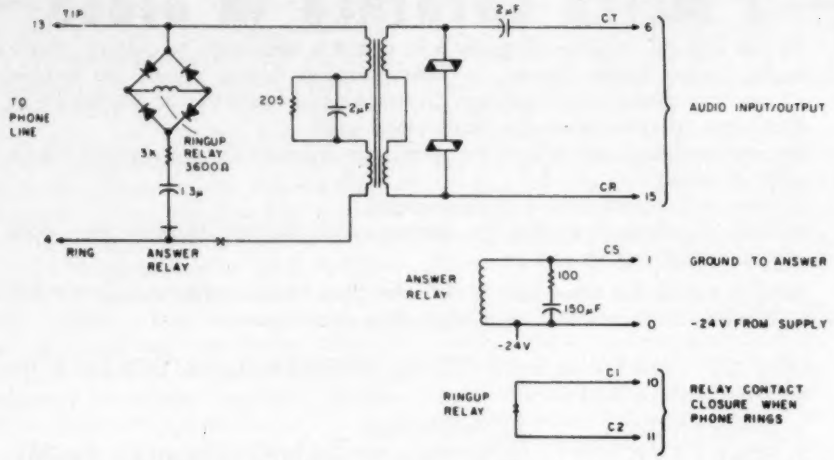

Fig. 10. Simplified diagram of 108A IU (Interconnecting Unit) which is part of the CD6 Voice Connecting Arrangement.

transmission rather than voice transmission, though it can handle voice and Touchtone as well. It differs from the QKT mainly in price ($2.46 a month and $30.74 installation) and in the fact that it has a built in test oscillator which allows the phone company to test it remotely without sending a man out. Here is another example where the phone company charges you extra for a feature whose only purpose is to save the phone company money.

Of more interest are the couplers suitable for automatic operation. For example, there are several couplers designed for connecting a privately-owned switchboard to a telephone line. Fig. 10 shows the insides of a CD6 coupler (which costs $4.86 a month). Fig. 10 is actually a simplified diagram of the 108A circuit board used in the CD6 as well as some others. In addition to the transformer and varistors which are in almost every coupler, there are now two relays and a few other components. This particular coupler is designed for incoming calls only. When an incoming call comes in, the 20 Hz ringing signal is rectified by the bridge rectifier and operates the ring up relay, which closes contacts C1 and C2, which can be used to light a light, sound a bell or in some other way signal the call. To answer the call, you ground the CS terminal which energizes the answer relay. This relay switches the telephone line from the ring up circuit to the transformer, which completes the dc circuit through the coupler so the CO knows that the call has been answered. Once this is done, you can feed audio in and out via the CT and CR leads.

Since this device is designed only for incoming calls, the phone company has to make sure you don't misuse it. Hence the RC network across the answer relay coil is there so you can't pulse it fast enough for dialing. (The varistors are probably chosen so you can't feed enough audio through for Touchtone dialing either.) Even if you could pulse the relay coil fast enough, it might not be fast enough to reproduce the dialing pulses without distorting the 60-40 ratio of off and on.

A somewhat more interesting series of couplers is the CD7, CD8 and CD9 group. They all use the 102 series PC board, which is shown simplified in Fig. 11. This board is designed for both incoming and outgoing calls. (The 102B is a newer version of the 102A shown.)

On an incoming call, the 20 Hz ringing voltage energizes the ring up relay, which gives you a contact closure on the C1 and C2 leads. (As with most of these, this is not a clean closure. Due to the low frequency and the bridge rectifier, the relay is pulled in on every half-cycle of the ringing, and so the

relay contacts pulse at a 40 Hz rate for 2 seconds and then release for 4 seconds, in step with the ringing.)

To answer the call you ground the CS lead, which closes the answer relay K4. This disconnects the ringing bridge from the line and completes the circuit through the transformer. Now you can feed audio in and out via the CT and CR leads, and at the end of the call you release the CS lead from ground.

For an outgoing call you start by grounding the CS lead, which closes K4, completes the dc circuit across the line and allows you to hear the resulting dial tone on the CT and CR leads.

Dial pulses are generated by momentarily opening the CS lead, which pulses the K4 relay. But this also operates the delay relay K5, which pulls in and doesn't release until a short time after the last pulse. K5 substitutes a resistor dc load across the line instead of the transformer; this prevents the dialing clicks from appearing on the CT and CR leads. Touchtone dialing through the coupler is also possible. K2 and K3 provide an interesting additional feature. As mentioned earlier, normally the tip is positive and the ring negative. But it is possible to order a service called toll diversion or toll denial, where the CO automatically reverses the polarity on your line during long distance calls. (In some CO's this feature may exist on a line without having to be ordered.) If this happens, K2 closes, which in turn operates K3 and closes the relay contact between the CRV1 and CRV2 leads. This can be used by the customer's switchboard to automatically prevent long distance calls from being made.

Since the same PC board is used in a variety of couplers, how do they differ? Here's the summary:

The CD7 ($5.35 a month and no installation charge) has all of the circuitry in Fig. 11, but the C1, C2, CRV1 and CRV2 leads are not brought out to the "customer's side" of the connection block. You need a ¼" piece of wire to bring the lead from the telephone company side to the "customer's side." In other words, the CD7 is supposed to be used only for outgoing calls without toll diversion.

The CD8 (also $5.35 a month) has the CRV1 and CRV2 jumpers but not the C1 and C2 jumpers. Here the 2 jumpers are free, right?

But if you want the 2 jumpers on the C1 and C2 leads, that makes it the CD9, at $7.99 a month. This time the two lousy pieces of wire cost you an extra $2.64 a month. I wonder how many million percent profit that makes – each month.

The 102-series board is also used in several other couplers. For example, a CET coupler is just like the CD7 but connected directly to a long distance operator rather than to a CO dial line. The C2ACP ($7.42 a month and $29.43 installation) is just like

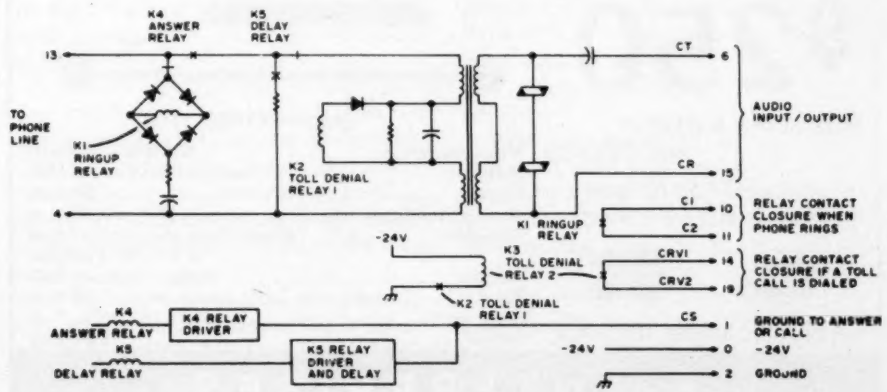

Fig. 11. Schematic diagram of the 102A IU (Interconnecting Unit) used in the CD7, CD8, CD9, CET, C2ACP, C2AKS Couplers. The 102B is similar.

the CD9 but for connecting a customer-owned push button telephone rather than a whole switchboard to the line. The C2AKS coupler is also just like the CD9 but for a slightly different application. Since the CD9 is for a switchboard, the CD9 would normally be on the line without having a regular telephone set connected as well; the C2AKS is intended for connecting other equipment to a line which already has a regular or push-button telephone on it.

Two other couplers which are very similar to the above in function although they are built completely differently are the CBS and CBT data couplers. Designed for carrying computer data by means of tone modulation, they handle voice and Touchtone signals just as well. The CBS uses digital logic signals for control and costs $6 a month and $25 for installation. The CBT uses relays and so is a bit cheaper — $4 a month and $25 installation. But the CBT needs an external 24-volt dc power supply. If you don't supply your own, the CBV supply will set you back an extra $1.85 a month.

The CBT works in a very similar fashion to the CD9, but whereas the CD9 has a single lead (CS) which controls both K4 and K5, the CBT splits this up into two separate control leads, one for each relay. You have to operate both control leads sequentially.

The CBT and CBS differ in two interesting respects, though from the CD9. First, the data couplers are normally supplied with a separate telephone which has an exclusion switch which can be wired so the coupler is normally on the line except when the phone is being used. I believe this means that if you add a CBT, for instance, to your home line which already has one telephone set, for the $4 extra you get not only a coupler but also a second phone.

The second difference is also interesting. The telephone company will normally not charge you for a call unless it exceeds about 1 second duration. You normally can't say much in 1 second, but a computer could send quite a bit of data in that time. And so the CBS and CBT couplers have a built-in time delay of 1 to 3 seconds which doesn't let you hang up too fast. More on this later.

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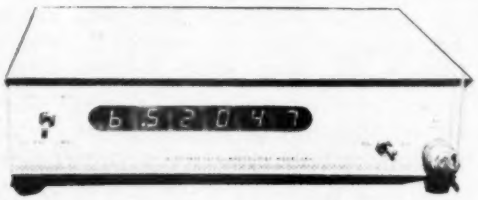

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Getting Your Canadian License

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So you are going to Canada for a visit (or may be there on business) and want to take your rig along so that you can continue your mobile and portable activities. What to do?

In 1951 a treaty was signed between the U.S. and Canada entitled "Convention Between Canada and the United States of America relating to the Operation by Citizens of Either Country of Certain Radio Equipment or Stations in the Other Country." Because of this lengthy title it is usually referred to as "The Reciprocal Agreement."

It is under the provisions of Article III of "The Reciprocal Agreement" that the Federal Communications Commission (FCC) in the U.S. and the Department of Communications (DOC) in Canada may grant permission for licensed amateurs of one country to operate their stations while in the other country.

Administrative procedures have been kept to a minimum. To obtain the necessary authority, an American amateur should take the following steps:

1. Write to the DOC requesting Form 16-52. (See list of DOC addresses at end of article.)

2. Carefully complete *both* sections of Form 16-52 and mail it to the DOC Regional Office *nearest to your intended point of entry into Canada.* There is one exception; if you intend to cross the border into Ontario, send the form to the Toronto office. (See list of DOC addresses at end of article.)

In the section on the application form which asks you to specify the area of proposed operation and the time periods concerned, it is in order to state "Occasional (frequent, periodic, etc.) visits during 1975/76", or similar. There is no need to make separate applications for each visit; it only results in more paper work, and who needs that?

While instructions on Form 16-52 require at least 60 days to be allowed for return of the authorization or Certificate of Registration, this time is often shortened to 10 days. However, don't leave it until the last minute!

When you have received your Certificate of Registration from the DOC be sure to carry it (or a photostat copy) whenever you take your rig into Canada. The certificate will be recognized by Canada Customs officers at the border and will facilitate the entry of your equipment. Without the certificate, Customs may seal your equip-

ment or even require that you remove it and leave it at your port of entry. Should your equipment be sealed never remove or break the seal yourself while in Canada, even if you subsequently receive a registration card. Customs' seals may only be legally removed by a Customs officer. There are severe penalties under the Customs Act for tampering with or removing a Customs' seal.

In Canada there are only two classes of Amateur Radio Operator's Certificates – "Amateur" and "Advanced Amateur." These are considered by the DOC as the equivalent of the FCC "Conditional" and "General" and the "Advanced" and "Extra" classes of operator licenses. There is no equivalent of the "Novice" and "Technician" grades in Canada. This, in effect, means that U.S. Novice and Technician licensees cannot be granted reciprocal privileges and authority to operate their stations in Canada.

It should be noted that Canadian terminology concerning operator and station authorizations differ somewhat from that used in the U.S. In Canada, an individual is issued with an "Operator's *Certificate* of Proficiency in Radio" which authorizes him (or her) to act as an operator of a certain class or classes of radio stations. A "radio station *license*" authorizes the establishment and operation of appropriate radio equipment.

By legislation there is only one class of amateur station license in Canada; the subband frequencies which an amateur may use are governed by the class of operator's certificate held by the licensee. The holder of a professional First or Second Class Radiotelegraph Operator's Certificate does not have to hold an Amateur Operator's Certificate, since his professional certificate is of a superior class, and is entitled to all the privileges of an "Advanced Amateur."

At the present time Canadian legislation concerning amateur operation is contained in the "Radio Act" and the "General Radio Regulations, Parts I and II," which may be obtained from Information Canada outlets in Ottawa and other major Canadian cities. To the uninitiated, these, like many other government documents, are difficult to follow because of the numerous amendments and revisions. The Canadian Amateur Radio Federations Inc. (CARF) has produced a book entitled "The Canadian Amateur Radio Regulation Handbook." This publication contains extracts of all Canadian legislation relating to amateur radio as well as a layman's explanation of how the regulations are interpreted and applied. It is available from CARF Inc., P.O. Box 356, Kingston, Ontario, Canada, K7L 4W2 at $4.00 a copy.

List of Addresses of Department of Communications (DOC) Regional Offices.

Department of Communications, Room 300, 325 Granville Street, Vancouver, B.C. V6C 1S5;

Department of Communications, 2300 – One Lombard Place, Winnipeg, Manitoba R3B 2Z8;

Department of Communications, 9th Floor, 55 St. Clair Avenue East, Toronto, Ontario, M4T 1M2;

Department of Communications, 20th Floor, 2085 Union Street, Montreal, P.Q. H3A 2C3;

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An Expensive Chase

Several years of watching the unfolding of slow scan programs on 14,230 kHz made it obvious that there is room for improvement in several departments. Program material, for one – slow scan eats up television material almost as fast as commercial television – and how many times can you watch that tape of those girls from Florida? Lousy editing, resulting from the use of cheap tape recorders, is another. Apparently very few slow scanners have a tape recorder with a pause control. Jittery lines is another almost universal misery – and one that is easy to fix since all it requires is a better recorder.

The fact is that you can turn out usable slow scan pictures with even the cheapest of cassette recorders. The recorder used on the KC4DX trip was one of those $17 specials, yet the pictures sent out by it – even with only acoustic coupling to the transceiver mike – were good enough to give quite a number of alert slow scanners a new country. Pictures sent back to Navassa and recorded via the speaker were still plenty good enough to copy upon return to the States – including one retransmission of the KC4DX pictures!

The inexpensive cassette recorders are usable, but the pictures they provide are far from good. The easiest indicator of the problem is that fluctuating left edge of the picture. The problem, if you open up a few of these recorders, is simple to isolate – the tape drive is from a single motor and via a rubber belt – a rubber band. This is okay for the design function of these recorders – dictation – low fidelity recording – telephone taps – playing the 73 Morse Code cassettes – etc. But when it comes to an application where speed regulation is important that rubber drive belt is too bouncy and the drive moves ahead in incremental spurts, jiggling your slow scan pictures.

Well, you may say, of course you can't expect much from a cassette recorder which is manufactured in Japan, sold by the manufacturer at a profit to an exporter who, in turn, sells it at a profit to an importer in the U.S. – who then pays the shipping costs and customs duty, adds on his costs of business and profit, and sells it to a dealer – who again marks it up to cover his costs and profit – and sells it for $17. How much can the recorder be really worth? No wonder it is jumpy!

Perhaps we have to look at the medium priced cassette machines? It will cost you a bit, but look, if you like. You'll find that there is very little difference in the cassette drive mechanism, that the added costs have been put into fancier cases, bigger loudspeakers, more power, more controls, more flexibility – perhaps an ac power supply – or an AM/FM radio. The drive is exactly the same!

Hmmm. The next step is the $100 recorders – how about them? When you remove the back you'll see little change in the drive systems – one motor and a big black rubber band. Oh, you'll have stereo now, maybe even a counter hooked in, a pair of recording meters, and other accessories – but the slow scan picture you get still jiggles as badly as ever! You may even discover, if you try several of these recorders, that no two of those drive wheels are exactly the same – with the result that no two recorders will play back at the same speed. The variation is substantial and cannot only change the pitch of music so you can't

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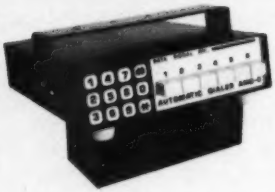

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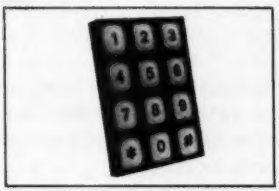

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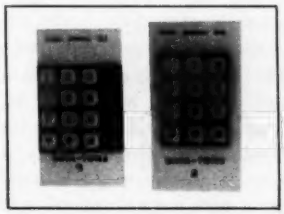

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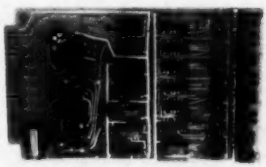

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The Sony TC-152SD.

accompany it with your own instrument, but can change the speed of Morse Code by from a half to one word per minute if you use it for practice.

Your slow scan pictures will begin to settle down when you get into the better cassette recorders – the ones with two or three motors and wow and flutter down in the .05% range. Now you are in the $250 and up range, which may be a little rarified for just slow scan, even for perfectionists. You can adjust to the cost of this necessary unit if you also are interested in hi-fi and thus have a good second application for the cassette deck.

Recommended Decks

After trying many different recorders, certain features developed importance and the selection of truly great cassette decks narrowed. Since most amateurs will probably want a deck that is as ideal as possible for slow scan, useful for hi-fi and perhaps even good for portable use, the selection of decks is very narrow: one.

The deck must have that .05% wow and flutter – a pause control – a provision for monitoring the recorded signal – stereo/mono capability – monitoring meters – Dolby noise reduction circuit for music – bias for normal, hi-fi and chromium tapes – ac/dc power – mike/line inputs – and hopefully a placement for the cassette which permits hand turning of the tape for micro-editing – and maybe a built in speaker so the unit can be used as a tape player, too.

Although there are about fifty different manufacturers of cassette tape recorders, and probably over 250 models to choose from, only one meets these specifications – the Sony TC-152SD. One of these was bought from Henry Radio and tried out – it made all the difference in the world on the slow scan pictures.

The pause control made it simple to start the recorder instantly and catch the sync pulses which begin each picture. The editing of the cassette was very easy because the cover from the cassette pocket was removable and a tooth pick then could advance the tape or rewind it manually to get the exact spot on the tape.

The 152 soon was moving back and forth – into the hamshack for slow scan – back into the living room to tape Boston Symphony concerts – or to play endless cassettes of Scott Joplin as background music during the day at the office – then off to a convention to record with professional quality the talks being given. There have been so many applications for the 152 that it has been in daily use. Like the frequency counter and the microwave oven, once you get used to it you don't know how you did without it.

But what about reel to reel recorders? Oh yes, these have been in use in the shack and with the hi-fi system for many years. No doubt reel to reel machines will be around for many years, but as far as ease of use is concerned, they don't make it. They are big

and cumbersome; the tape is expensive, as well as difficult to thread and change; and the system for putting four channels on that quarter inch tape is insane. They stagger the four tracks! On cassettes the one-eighth inch tape has four tracks, but the two stereo channels are side by side going each way.

Whether you are going slow scan or music, the fact is that you want to be able to change tapes easily and quickly – and this means cassettes. The better cassette decks automatically turn off when the end of the tape is reached, so you don't even have to worry about that.

Cassette Lengths

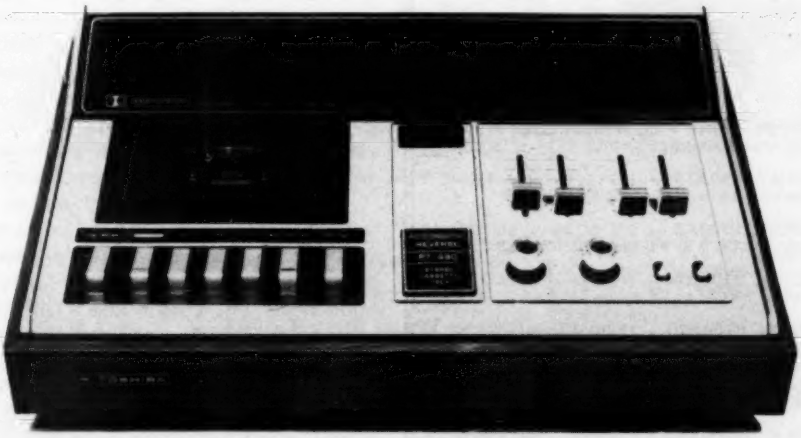
Cassette tapes are available in several lengths, the most popular being 30, 40, 60, 90 and 120 minutes. The 40 minute cassettes were primarily designed for taping LP records, which generally run about 20 minutes per side. The cassette case seems to have been designed to be the right size to fit .003" thickness tape which will play 30 minutes per side – the C60 tape.

C90 tapes have to be made using thinner tape and there are some drawbacks to this – serious drawbacks. The thinner tape (.002") has a tendency to get jammed in the drive mechanisms of the cheaper recorders. You can get pretty fed up with the slight advantages of the 90 minutes of tape after pulling a foot or two of it out of your recorder and finding you have to cut the wrinkled mess out of the cassette and patch what is left together. Unless you have a lot of patience you'll quickly get very tired of repairing the fragile tape.

C90 also has a couple of other disadvantages – as if it needed more – such as having a lot more print through. As you may guess, print through is a transfer of some of the magnetic impression from one layer of the tape to another – giving you a ghost signal added to your music. Eery and useless. One last problem – some of your flutter comes back, despite the expense of the drive mechanism, three motors, etc. The tape is now so thin that it acts like a rubber band!

If there are problems with the C90 tapes you can just imagine the hassles with C120 tapes! These are .001" thick and are more valuable as a demonstration of the marvels of modern engineering than as tapes for hi-fi music or slow scan. Even on a $350 deck these sound lousy.

A word of warning regarding el cheapo tapes – don't. You may ignore that warning without explanation since the drive to get a bargain is stronger than reason in most people. As an example – one of the dealers in the Boston area has some very reasonable cassettes on sale – real bargain – perhaps. C60 tape at 65¢ each! Four for $2 – boy, let's have a couple dozen of those! Brand new, too! One educated look and you'll see



The Toshiba PT-490.

the kicker – the roll of tape in that cassette is a lot smaller than you are used to. Now how come a C60 cassette has a little tiny roll of tape in it? Right! They used .001" (one mil) tape so you have all the miseries of C120 without the single benefit – length.

Some junk cassettes will jam, spilling tape into the wheels of progress. Others will bind, aggravating any rubber band bouncing of the drive belts – etc. Unless you have a guarantee of refund or replacement, watch out. Since even the best of the cassettes sometimes come acropper, it is best to always be sure of your supplier and the fact that he stands behind the cassette . . . unless you would like to build up a series of interesting stories to tell friends about tape bargains you got which turned out to be disasters . . . like that bunch of C60s you got at the auction which wouldn't record.

Cassette tape comes in a bewildering number of brands and prices – in voice quality – music quality – hi-fi – chromium – etc. Voice is adequate for SSTV work – and for medium fidelity music. Beyond that it is a question of how high you want your highs to go and how low the lows. With a good machine and good tape your cassette will provide 20-18,000 Hz, which is about all you can want for hi-fi.

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MODEL P100A20 – 15-30 W input 75-100+ W output. 13.6 V at 14 Amps $155 ppd.

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M-TECH . . . *The Quality Company*

The Toshiba PT-490

One of the slight drawbacks of the C60 cassette is that it runs only 30 minutes on a side. Considering that 78 rpm records ran about 2-1/2 minutes for the 10" and about 4 minutes for the 12", with LP's running about 20 minutes per side, the 30 minute limit would not seem to be a serious problem.

Toshiba is one of the first to come up with a cassette deck which automatically reverses at the end of the tape if you want. It will even continue to play the same tape back and forth, over and over, if you set the control for that. This means that you can have the benefit of a one hour recording without stopping on a C60 cassette – losing only a few seconds during the turn around.

The PT-490 sells for $350 and has most of the sophisticated circuitry the hi-fi bug needs today. Obviously this is absolutely ideal for demonstrating slow scan television for dealers since the 490 will sit there and show programs continuously. It has the Dolby Laboratories noise circuit to overcome tape hiss, three bias positions, mike or line inputs, pause control, counter, individual monitor meters, and a special jack in the back which mates with other Japanese hi-fi units so you don't have to patch all those individual wires – in addition to the jacks for the individual wires, if you need them. There are individual input and output volume controls (the Sony 152 has only output volume controls and a volume control for the built in monitor amplifier).

Toshiba has stepped way out in front with the 490 in cassette deck design. Before that the Toshiba line had mostly been a bit behind the pioneers in the field – very good equipment, but conservative. Toshiba has some more pioneering cassette decks on the way, expected in a couple of months – probably in the $650 range. That's a far cry from the $17 cassette recorder.

. . . W2NSD/1

Warren MacDowell W2AOO
11080 Transit Road
East Amherst NY 14051

AC Power for the HW-202

Or Any Other 12V Mobile Rig

The Heathkit HW-202 was designed primarily for use with an automotive 12 volt dc power source. However, this rig works very well as a base station with the power supply we are about to describe.

The power transformer that was pressed into service was a triad F-32A. This particular transformer has two separate 6.3 ac windings, each of which are rated at 3 Amperes. These windings were put in series to provide 12.6 V ac. It must be remembered that when placing two windings in series, they must be "in phase." When you first series the windings measure the resultant ac voltage. If it is not 12 V ac, one set of the windings must be reversed.

In the receive mode, the HW-202 draws about 100 milliamperes at 13 volts dc. This is with the squelch "on" and no audio present. This resting current will increase with audio; however, the average receive current is low. When in the transmit mode, the current increases to 2 or more Amperes at 13 volts dc. Therefore, it was necessary to design a supply which could provide in excess of the 2 plus Amperes needed in the transmit mode.

Just about any filament transformer with a single 12.6 ac winding or two 6.3 ac windings and adequate current rating (3 Amps) will suffice in this supply. Should nothing be available in the junk box, an old TV set transformer can be used if space is of no concern.

The high voltage windings can be taped up and just the 6.3 ac and 5.0 ac windings placed in series. In older TV sets, the 6.3 winding provided normal tube filament voltage and the 5 volt winding took care of the 5U4 rectifier. Both of these windings generally were capable of considerable current.

These two windings in series will provide about 16 V dc after the rectifier bridge and is adequate to supply the regulator which is working at 13 V dc.

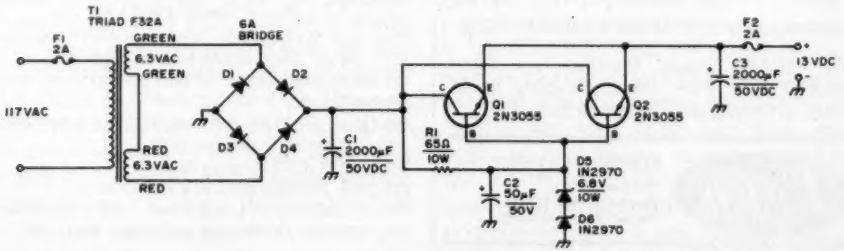

Fig. 1. HW-202 regulated 13 V power supply.

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The rectifier is an "encapsulated" bridge that can be obtained at Radio Shack outlets. These particular bridges should be mounted directly on the chassis which acts as a heat sink. Radio Shack sells two different bridges that are rated at 50 volts, 6 Amps and 200 volts, 6 Amps. The 200 volt, 6 Amp bridge is more conservative and tolerant of line surges, and thus might be a better choice for the supply. Of course, individual diodes can be used in the bridge but should be able to withstand the necessary current.

Nothing bothers us more than having components run "hot" under a normal load. Therefore, a pair of 2N3055 pass transistors were used to regulate the 2 Ampere load. The 2N3055 will handle up to 4 Amperes so the pair easily handles the 2 Amps.

Although 12.6 ac is put out by the transformer, the bridge rectifier produces approximately 16 to 18 V dc. The pair of 1N2970 zener diodes in the base circuit of the 2N3055s holds the output voltage down to 13 V dc. The 65 Ohm, 10 Watt resistor limits the current to the zener diodes so that the dissipation of the diodes is not exceeded.

The reason that two 6.8 volt zeners were placed in series was that we did not happen to have a 13.6 volt zener handy. A 1N2979 (15 V/10 Watt) might be used but the output voltage might be a bit high . . . in the neighborhood of 14 V dc.

Of course, the use of this supply is not limited to use with the HW-202. Just about any of the modern transistor type mobile FM rigs in the 10 Watt power range will work well with this supply. Our particular unit has been in use for nearly one year with no problems at all.

Power Supply Parts List

C1, C3 – 2000 uF, 50 V dc electrolytic capacitor.
C2 – 50 uF, 50 V dc electrolytic capacitor.
D1-D4 – 200 volt, 6 Ampere encapsulated bridge (Radio Shack).
D5-D6 – 1N2970, 6.8 volt, 10 Watt zener diode.
F1 – 120 V ac, 2 Ampere fuse.
F2 – 12 V dc, 2 Ampere fuse.
Q1-Q2 – 2N3055 NPN silicon transistor.
T1 – Triad F-32A transformer, 115 V ac primary, two 6.3 V ac, 3 Ampere secondary windings.

. . . W2AOO

Pete Walton VE3FEZ
421 Lodor Street
Ancaster, Ontario
Canada

Now What Have I Done?

Here is a simple circuit, Fig. 1, that makes an excellent one evening project and can result in lots of fun. It relies on the fact that man is of a very curious nature and doesn't really believe everything that he reads. The circuit is mounted in a small minibox. The push-button is labelled *Do Not Touch* in plain writing and very visible. Now, anytime you label something *Do Not Touch* somebody is bound to touch it. . .it never fails! It's human nature. The person whose curiosity has gotten the best of him, however, will get very red faced and embarrassed when he finds there is no way to turn off the noisy thing that he has just started. How does it work? Very simple, the power to the two transistor oscillator is controlled by an SCR. When you push the button you gate the SCR causing it to conduct and the audio oscillator to run. Once an SCR has been gated and is conducting there is no way to shut it off unless you disconnect the power or reverse the polarity on the diode. It is at this point that the poor fellow who pushed the button says *Now, what have I done*. In this circuit we disconnect the power and stop the noisy oscillator by means of a magnetically controlled normally closed reed switch. I made the reed switch normally closed by glueing a small magnet to it with some epoxy glue. The small magnet glued to the side of the reed switch causes the switch contacts to be closed all the time. However, if you place a slightly larger magnet near the already closed reed switch it will oppose the magnet that is glued to the switch and the points will open as long as the magnet is held in close proximity to the switch. Mount the reed switch against the inside edge of the plastic or aluminum minibox (don't use a steel box or the magnet will not work). When you want to shut off the oscillator simply rub the magnet against the outside edge of the box where the switch is mounted. The magnet will open "the points" and the unit will shut off. Unless the unsuspecting victim carries a magnet with him there is no way he can shut it off. I built mine in one evening completely out of junk box parts. Almost any two transistors will work as long as one is NPN and the other is PNP. The SCR that I used came out of a bag of assorted untested SCRs that I bought for $1.69. I tried four different SCRs out of this assortment of ten and all of them worked with no difficulty so the SCR is not very critical. You could also replace the push-button with a mercury switch if you wanted to be real nasty and the oscillator would start as soon as somebody picked it up. An excellent portable burgler alarm. After you build it just leave it on your desk and it won't be long before some poor soul gets just a little too curious. I leave mine in the Ham shack on the bench and everytime I get a visitor he picks it up, looks it over and pushes the button. Never fails.

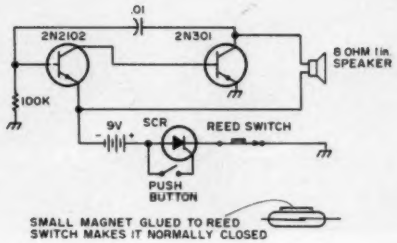
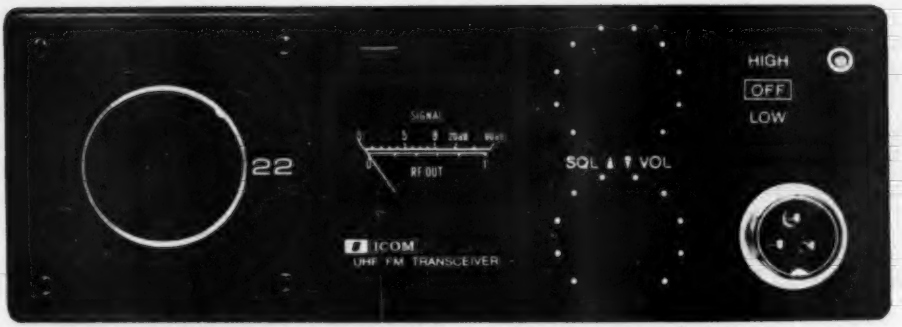


Fig. 1.

. . . VE3FEZ

IF YOU HAVE ALREADY GONE 450 . . . .



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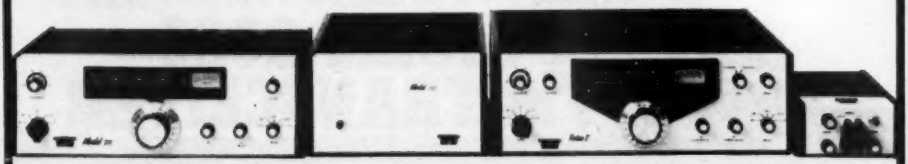

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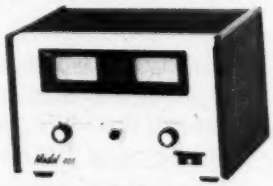

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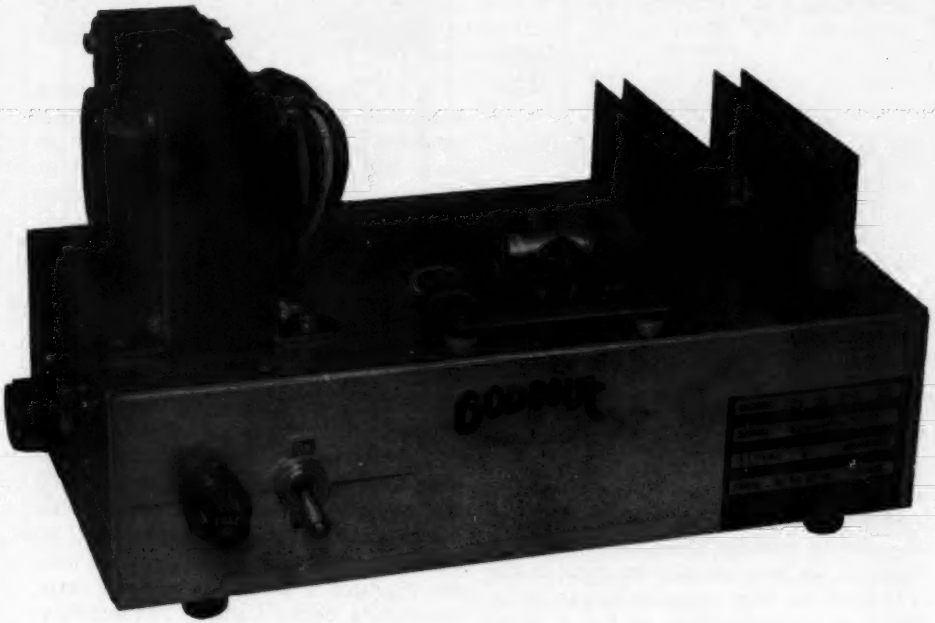

A Hefty 12 Volt Supply

If you've ever needed a good, regulated 12 volt power supply, for powering your mobile rig while at home or just to sit on your test bench, this is the one. It provides an adjustable output over an 11 to 14 volt range, keeping regulation to better than 100 millivolts. The output is set to current limit at 6.5 Amperes (although you can change that to 13 Amperes). Additionally, the power supply is protected against transients and reverse voltages at the output terminals.

Fig. 1 shows a conventional regulated high power supply. Using a 723 voltage regulator gives the necessary precision and regulation; a hefty external pass transistor, complementing the 723's internal pass transistor, provides the power. Although this type of circuit works reasonably well, making a few circuit changes can achieve far better performance.

Modification number one is to use a Darlington power device as the pass element. The MJ3000 specified has a gain of 1000 at 5 Amperes. This high gain requires less base current, keeping a light load on the regulator. The actual amount required to drive the MJ3000 is about 1.5 mA per Ampere of output current. Taking the 723 quiescent current into account, the 723 is left with a worst-case current load of under 12 mA, promoting a stable and cool-running regulator section.

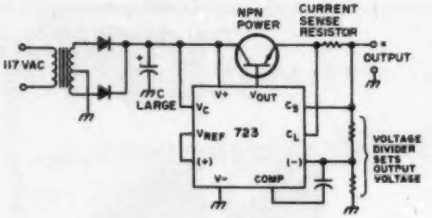

Fig. 1. Conventional regulated high current supply.

To understand modification number two, it's necessary to look at the schematic (Fig. 2) and fool around with some numbers.

With a conventional capacitive input filter (which this is), ripple voltage increases linearly with output current. Despite the large amount of capacitance (5 paralleled 4000 uF caps for a total of 20,000 uF), in a situation where you're drawing 6.5 Amperes there is a ripple voltage of about 3 volts peak to peak across the filter bank. Like all IC regulators, the 723 must have a somewhat higher voltage at its input than at its output in order to maintain regulation (typically 5 volts). If we were to take the input to the 723 from the filter capacitor output, as in the typical configuration of Fig. 1, there may not be enough drive to maintain regulation. Hence, in Fig. 2, we take a couple of diodes and another filter capacitor and derive the input voltage directly from the transformer secondary. Due to the light load current on the 723 discussed earlier, we can get away with a 250 uF capacitor; at 6.5 Amperes of output current, this means a ripple of 300 millivolts peak to peak at the regulator input, which is certainly enough to keep the 723 happy and regulating.

A few other points are worth mentioning. Bypassing V_{ref} to ground with a small tantalum capacitor substantially reduces any noise and ripple appearing at its output. Another point to consider is temperature stability (i.e. constant output voltage regardless of temperature). Resistors R1, R2 and R3 set the output voltage; since we're using carbon composition resistors, you might think the stability would not be too good. However, what matters in this case is the resistance ratio rather than absolute values. Since for 12 volt operation the trimpot is in its approximate mid-range position, any temperature variations tend to change all resistances equally, preserving the proper ratio and giving a constant output voltage. One extra point to consider: by tagging a resistor on the output to give a small minimum load, the regulator is always in its active state, maintaining better stability and accuracy. The tantalum capacitor connected across the output improves transient response.

Finally, at the extreme output of the power supply is a diode. Note that it's connected up to shunt any negative spikes or

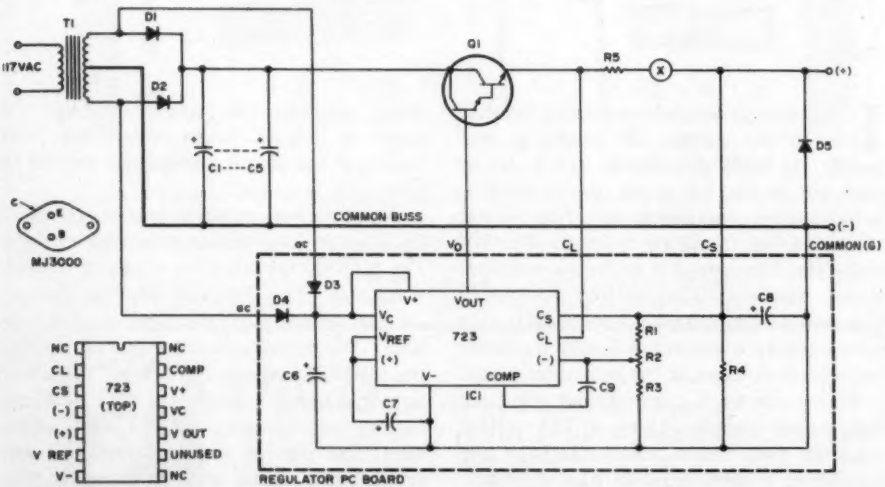

Fig. 2. 12 V power supply schematic. MJ3000: bottom view; C – case.

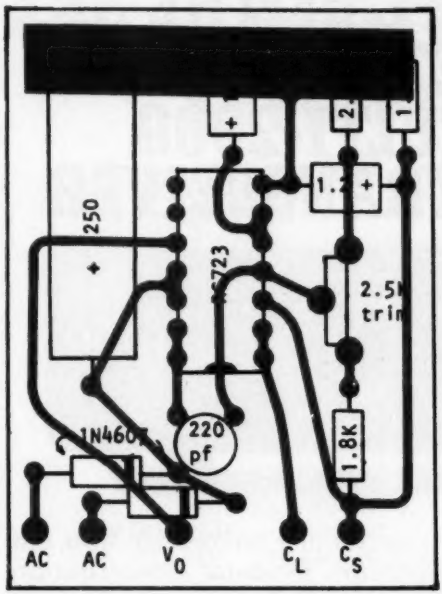

Fig. 3. PC board and parts layout (83.3%).

transients to ground before they can get into the power supply and cause any trouble.

One protection device that is not necessary but highly desirable is a fuse; in case anything should go wrong with the supply, it protects the device being powered. Because a fuse has a small amount of resistance, it should be inserted at point "X" on the schematic rather than at the supply's output. Even a resistance measured in milliohms can cause a measurable voltage drop at heavy output currents.

As far as assembly is concerned, the 723 and its associated components mount on a separate printed circuit board (Fig. 3). Six connections are made to this board, as shown in the schematic: 1 to the negative buss; 2 to the transformer secondary; 1 to the base of the MJ3000; and 2 across the current sensing resistor. The MJ3000 and the current sensing resistor should be mounted on a good heat sink. (Remember, this is a powerful device.) The transformer, filter capacitor bank, and rectifiers stand by themselves. Use heavy gauge wire to minimize any resistance. Also note that bussing together the negative line rather than grounding it gives a floating output; this is particularly useful in service bench and lab supply applications.

The .1 Ohm resistor given in the schematic, as mentioned before, limits current to 6.5 Amperes, plus or minus 5%. However, the transformer, diodes and MJ3000 can provide up to 8 Amperes continuously with good ventilation, or 10 Amperes intermittently. To change the current limiting point requires changing the value of the current sense resistor. Paralleling two .1 Ohm resistors gives a current limit point of 13 Amperes, sufficient to protect against momentary shorts.

(Postscript: Using these same principles can give power supplies capable of delivering up to 100 Amperes of regulated current. All that is required is making a more powerful transformer-diode-heat sink combination, increasing the filter capacitance, and paralleling an appropriate number of Darlington devices, adding a small value resistor on the emitter of each Darlington.)

Parts List

R1	1.8k ¼ Watt 10%
R2	2.5k trimpot
R3	2.7k ¼ Watt 10%
R4	1.5k ¼ Watt 10%
R5	.1 Ohms, 5 Watts or greater (see text)
C1-C5	4000 uF @ 20 volts
C6	250 uF @ 25 volts
C7, C8	1.2 uF @ 35 volts
C9	220 pF @ 25 volts
D1, D2	Rectifier diode @ 6 Amperes (Motorola MR1120 or equivalent)
D3, D4	1N4607 or equivalent
D5	1N4002 or equivalent
Q1	MJ3000 (Motorola) Darlington power transistor or equivalent
IC1	LM723 integrated circuit
T1	24-28 volt center tapped transformer @ 4 Amperes
Misc.	Line cord, chassis, mica insulators plus silicone grease, heavy gauge wire, fuse and fuse post, binding posts, etc.

A kit of parts including the regulator circuit board but less items listed under "misc." is available from Godbout Electronics, Oakland International Airport, California 94614 for $18.95 plus postage. The MJ3000 is available also for $1.95; for orders under $10, add 50¢ handling.

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- Selectivity:
  - FM: 15 kHz at -6 dB, Shape Factor 2.5:1 (6/60 dB)
    Ultimate rejection greater than 90 dB
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    Ultimate rejection greater than 95 dB
- Spurious Signals:
  Reduced more than 70 dB.
- IF Rejection:
  Greater than 60 dB.

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    High power 10 Watts (Typically 15 W)
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Bill Hoisington K1CLL
c/o 73 Magazine
Peterborough NH 03458

ICM Kit 2m Converter

This article describes a remarkable two meter converter made with four of those little 1½" x 1½" printed circuit boards from International Crystal. The total cost is only $17.50 and includes the control crystal, two rf stages, mixer, oscillator, and all the transistors.

I have assembled to date over a dozen of the International Crystal printed circuit kits and every one of them has performed exactly as claimed by the manufacturer. I have also taken advantage of certain techniques (mainly collector tuning) and have externally added two features which improve performance considerably. These added features you can treat in any of the following three fashions. 1. Do not include them. The converter still works fine. 2. Use them, and then if you decide to take them out again, do so. It's easy because they are external to the printed circuit boards. 3. Use them, and the converter really brings them in.

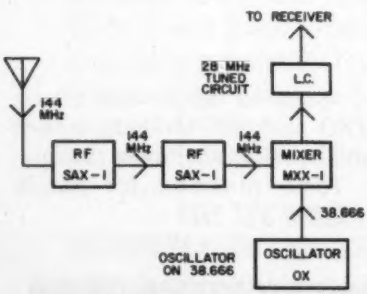

Fig. 1. Block diagram, two meter converter using International Crystal kits.

Each of the kits goes together in less than an hour. After allowing a little more time for cabling, battery connections, and possibly a "Long John" Yagi, you have no excuse for not hearing everything on the band.

The Rf Stages

I am a confirmed believer in more than one rf stage for VHF. It does a great deal for you. The in-band signals are there, they're loud, and they swamp out all spurious signals, birdies, and other annoying factors. One of these rf stages is a home brew job because of my not remembering to order two rf units from International. However, I checked the gain of both the International and the home brew one and they're both good, so the International wins because it costs only $3.50 and takes just an hour to build.

The circuit is shown in Fig. 3. One of the external "gadgets" was added to this stage. This is shown in Fig. 4 and is nothing more than a mica compression trimmer soldered

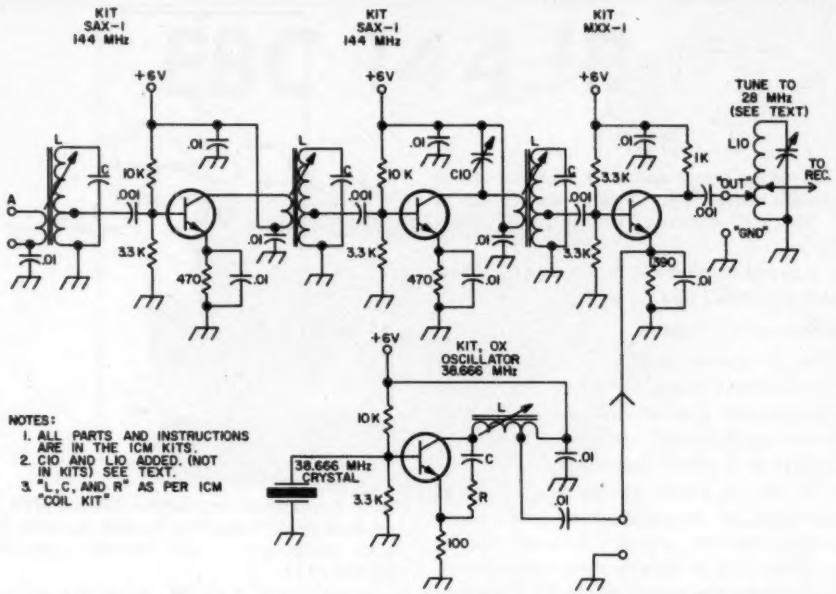

Fig. 2. Over-all circuit, two meter converter using International Crystal kits.

across the output terminals of the SAX-1 board and a special length of cable going to the one turn link in the mixer input. This tunes the collector circuit, as you can easily see in Fig. 4, with the coaxial cable forming the inductance. It works very well, giving much more rf gain into the mixer, and forming an additional in-band filter. In fact, if the mixer coil L2 is not properly tuned to resonance and loading the collector circuit, which is now being tuned, it is possible for it to oscillate due to the base already being tuned, as in Fig. 3.

With the mixer properly tuned this will not happen, and the rf stage gain will show a large increase.

Remember the caution mentioned earlier,

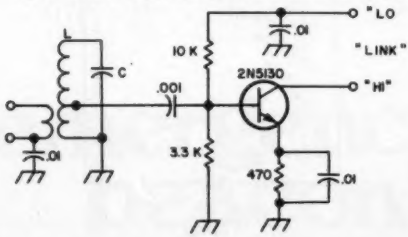

Fig. 3. SAX-1 International Crystal kit, 144 MHz rf stage.

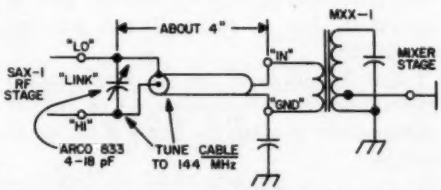

Fig. 4. Tuned collector for SAX-1 rf stage. Note: The tuned circuit in the output of SAX-1 is about 4" long including the phone plugs.

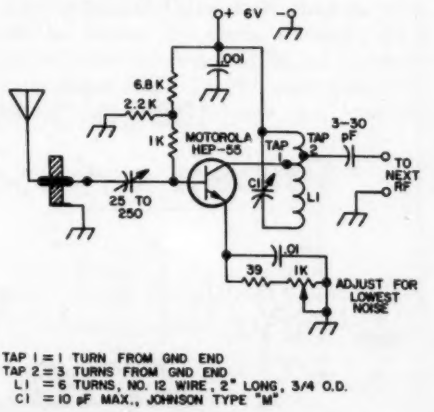

Fig. 5. Second rf stage, 144 MHz (shown nearest the antenna in Fig. 1).

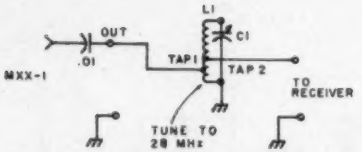

Fig. 6. Adjust taps 1 and 2 for best gain and/or bandwidth desired. L1 – 6 turns No. 14 wire, 1 inch long, 7/8" diameter. C1 – ARCO 426, 35 to 275 pF.

that you can remove this extra capacitor any time if you don't like its action.

The Second Rf Stage

This is shown in Fig. 5 and is a very simple affair to build, but even so it takes a lot longer than the International kit because it is not on an already printed board with all the parts in a plastic bag ready for you. So that is why I advise getting two of the rf stages right off. You will notice in this home brew job that the collector is tuned and the base is not. If you wish to use a tuned circuit into the base, the circuit of the SAX-1 board is good. Adjust the base tap so that no oscillation occurs. With the untuned base as shown in Fig. 5 you will not get any oscillation.

And if you order the kits after reading this article you will probably get two of the International rf stages, so that's it for the rf section.

The Mixer Stage, MXX-1

This kit went together, like all the other International jobs, with no trouble and in about an hour. Here again I decided to use a 5 pF capacitor across L1 instead of the choice of 6.8 pF tuning to 145 MHz or the 4.7 tuning from 145 up. These values were evidently not selected by a two meter

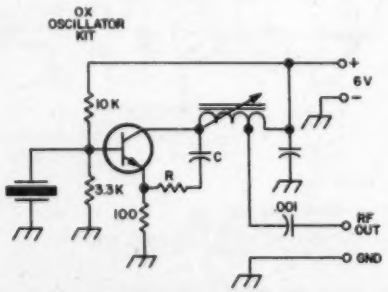

Fig. 7. Local oscillator, 38.666 MHz.

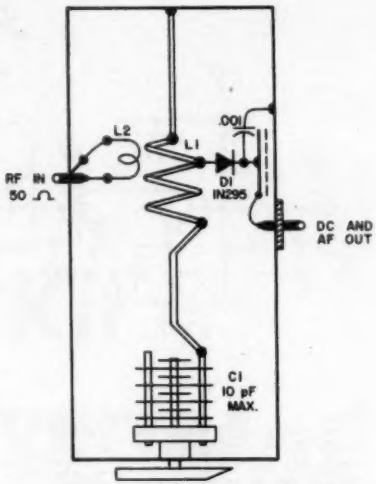

Fig. 8. Tuned diode test receiver, 100-200 MHz. L1 – 4 turns 9/16" long, 9/16" outside diameter, No. 16 air wound. L2 – 1 turn, movable, loose, over cold end of L1.

amateur, but with the 5 pF used for the "C" it adjusts fine over the two meter band.

Now comes the second outboard unit added. This one is recommended by the International Crystal people, as shown in

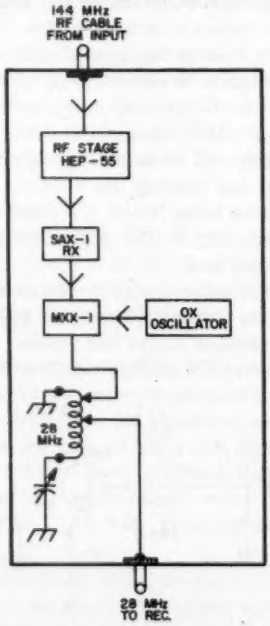

Fig. 9. Assembly layout, converter, International Crystal kits, two meters.

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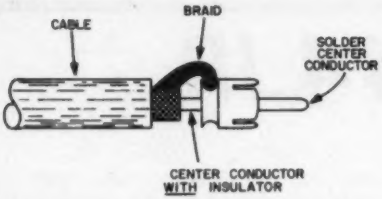

Fig. 10. RG 174/U cable and plug.

Fig. 6, and they say "connected to the receiver through a tuned circuit as indicated below" (Fig. 6). Having tried this out on the six meter converter and having found that the mixer output into the receiver was brought up very considerably, I installed it as the kits were assembled onto converter baseboard. It did the same for the two meter converter as for the six meter one, so don't leave this one out, unless for some reason you wish to tune over a much larger frequency range than one of the amateur bands. To broaden the tuning range of the circuit shown, place the taps shown in Fig. 6 up a little more towards the hot end of the 28 MHz tuned circuit.

On the mixer board the L can be peaked up easily on two meters with the threaded slug core while listening to stations, unless you have a well-shielded and properly attenuated signal generator on 144 MHz. The usual $30 to $40 job will not do on 144. For a test signal on 144, I use a 10 uW modulated crystal-controlled source installed about one-half mile away and use it to check between the International converter and my

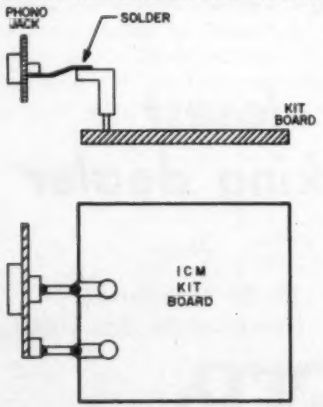

Fig. 11. Phono jack and International kit board connectors (side and top views).

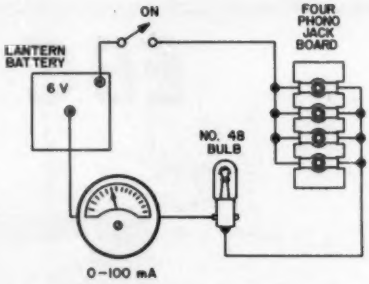

Fig. 12. 6 volt battery bench supply.

faithful old tube job using Nuvistors, as detailed later. Nothing more to say about the mixer. It works!

The Local Oscillator

With our receiver on ten meters, the converter crystal-controlled local oscillator should be on 116 MHz. The MXX-1 instruction sheet says "for injection signals from 120 to 180 MHz divide by three to determine the OX oscillator frequency." This calls for a crystal on 36.666 MHz, which we had ordered, and as soon as the oscillator kit was assembled and soldered, there was the 38.666 energy at the output. Figure 7 shows the circuit. Checking it out on 116 MHz for third harmonic content, a good volt of rectified dc was found at the output of the tuned diode test receiver on 116 MHz. This useful piece of test equipment is shown in Fig. 8, for the benefit of new readers. This unit can be built for almost any frequency up to about 1 GHz.

The local oscillator was now ready for assembly with the other units.

Assembling The Converter

Figure 2 shows the overall circuit. Each unit was mounted a little way off the baseboard on a single brass 6/32 machine bolt which was soldered vertically to the baseboard, so the printed board would clear

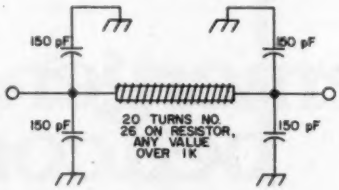

Fig. 13. Rf filter for battery leads, if needed.

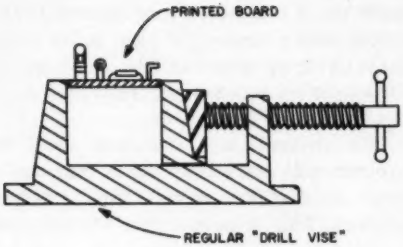

Fig. 14. Holder for soldering boards.

the baseboard and not have any of the wiring or solder points touch and short. Small coaxial cable type RG174/U, which is 3/32 of an inch O.D. was used to connect together the various units, along with phono jacks and plugs. The layout on the breadboard type baseboard is shown in Fig. 9. Signals from the bench generator were heard as soon as everything was connected, the various coils were peaked up, the outboard rf stage built and installed, and its taps varied to match the collector of the Motorola HEP55 transistor and the output cable to the SAX-1 International second stage.

Tricks and Tools of The Trade

As mentioned above, the use of the small rf cable type RG174/U helps with the 1½" boards for inter-connecting the units and carrying rf to the various test planks on the bench. A number of "phono" jacks and plugs are used for this work also. Some "purists" don't like to use these low-cost connectors, but I built the whole solid state 432er, crystal-controlled transmitter and triple conversion receiver using them as interconnectors and they worked fine. You can suit yourself on this question. They're not very good for outdoors of course, but they do have porcelain inserts for insulation and will carry 432 MHz, on a test basis, indoors. The plugs cost 3½¢ each at Lafayette, and the jacks 5¢. 'Nuff said. Fig. 10 shows a method of connecting them to the small cable.

Receiver Requirements

You need a receiver to follow your converter, and there are certain things this receiver should have or you will suffer on two meters and up. The most important turns out to be, not selectivity, gain, avc, or noise limiting, but image rejection. And right

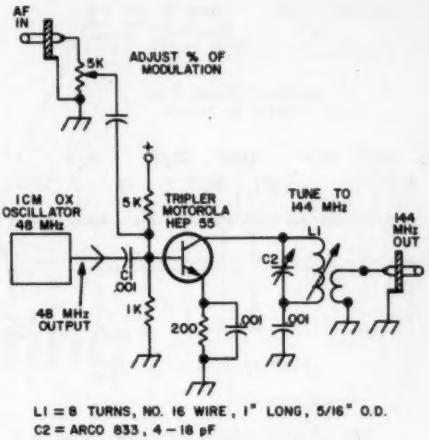

Fig. 15. rf test signal 144 MHz.

after that is a good smooth dial, easily turnable and handy for logging and/or calibration. The receiver I use is a full coverage one from .5 to 54 MHz, and as such has an i-f of 455 kHz. It is a good one, but on two meters following a single conversion the use of a 455 kHz i-f results in a bad image problem. One of the loudest stations heard on the band comes in equally well on 28 and 29 MHz on the receiver dial. Actually these points are 910 kHz apart. So you couldn't tell at first glance whether he was close to 144 or 145 MHz. A double conversion receiver with the first i-f on 1.65 MHz improves this situation greatly, especially if it has a three gang variable tuning capacitor with a tuned rf stage.

A Super 24 Foot "Long John"

Having manufactured amateur beams for over six years I can recommend this one, because I tuned it up on my own antenna

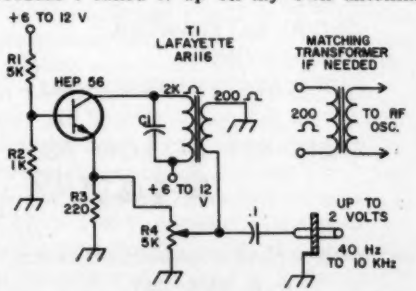

Fig. 16. Handy tone modulator for test signal. The value of C1 controls the af frequency.

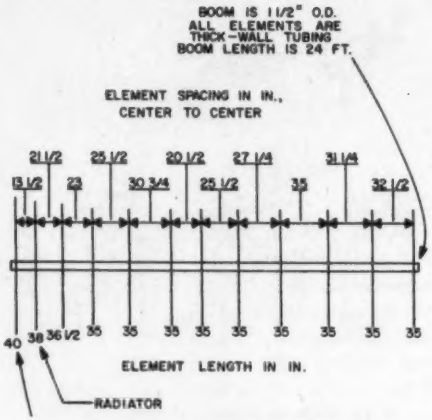

Fig. 17. Two meter "Long John" yagi.

range and have compared it with a number of other beams. I believe that this beam has the most gain possible for a 24 foot boom. I could include the design of my favorite 36 footer, but that kind is generally used only by two meter fanatics.

Figure 17 shows the 24 foot job with element lengths and spacings. The boom is made up of two twelve foot sections of 1½" tubing with a come-apart joint in the center for carrying up mountain tops. It is tuned up for maximum forward gain right now, so do not change any dimensions.

The elements are particularly useful for experimental and hilltop use as they can be bent accidentally several times without breaking. This is because they are not made with thin wall tubing, but instead are of thick wall stock. Try them and see how they act.

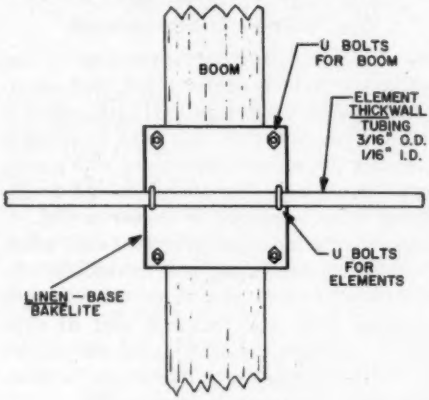

Fig. 18.

Figure 18 shows some details of the element mounting on the boom, and Fig. 19 details the gamma match.

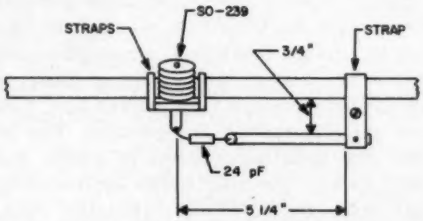

Fig. 19. Gamma match detail.

This is one you can hear W2's with every night up here in New Hampshire.

Conclusion

I hope this article on an excellent two meter battery converter from inexpensive kits will help you get acquainted with the band and spark you into going mobile – and hill-topping as well.

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Updating the Pocket Mate

Since I wrote the article on converting the G.E. Pocket Mate to 2m FM (October 1973, 73) I have come across several changes and additions that will improve the performance of this tiny transceiver. A couple of them (modifying the driver and increasing deviation on low-audio units) are almost mandatory. These changes are simple provided you have tools designed to work on tiny circuitry.

Increasing Drive

On some units it is impossible to get a Watt out, even with the drive pot(s) at maximum. The reason usually is that the driver will not tune low enough, even with the slug all the way in the coil form of T-10. Adding a small capacitor (ceramic or mica) to the designated place will cure this, and T-10 will peak with the slug approximately one third to one half of the way in the form. Some units have one of several different values ranging from 3.3 to 6.8 pF here, while others that used to operate over 160 MHz or so had none. If yours has a 6.8 pF capacitor already, that should be sufficient capacity. You can tell if this stage will tune low enough by seeing if there are two peaks as the slug is turned all of the way through the coil. There should be two.

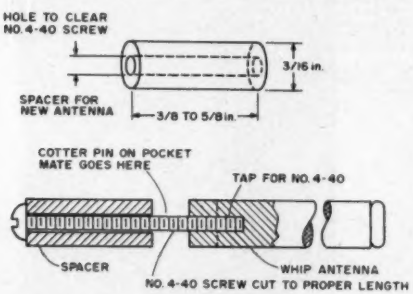
HOLE TO CLEAR NO. 4-40 SCREW
3/16 in.
SPACER FOR NEW ANTENNA
3/8 TO 5/8 in.
COTTER PIN ON POCKET MATE GOES HERE
TAP FOR NO. 4-40
SPACER
WHIP ANTENNA
NO. 4-40 SCREW CUT TO PROPER LENGTH

Fig. 1. Antenna mounting details.

Another Antenna

If your unit has a bent up or otherwise unsatisfactory whip antenna, it is fairly easy to replace with a new (and better) one for less than a dollar. Many electronic and TV shops sell a wide variety of replacement telescopic whips for TV sets and FM radios. The assortment usually includes a 5 section one that is about 12.7cm (5") collapsed and 45.72cm (18") extended. This makes an ideal antenna for 2m and it is easily adapted for the pocket mate, see Fig. 1. The mounting hardware is discarded and the tapped stud on the bottom of the antenna is sawed

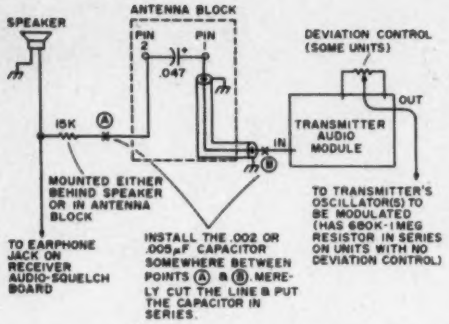
SPEAKER
ANTENNA BLOCK
PIN 2
PIN 1
.047
DEVIATION CONTROL (SOME UNITS)
OUT
IN
TRANSMITTER AUDIO MODULE
15K
A
B
MOUNTED EITHER BEHIND SPEAKER OR IN ANTENNA BLOCK
TO TRANSMITTER'S OSCILLATOR(S) TO BE MODULATED (HAS 680K-1MEG RESISTOR IN SERIES ON UNITS WITH NO DEVIATION CONTROL)
TO EARPHONE JACK ON RECEIVER AUDIO-SQUELCH BOARD
INSTALL THE .002 OR .005μF CAPACITOR SOMEWHERE BETWEEN POINTS A & B. MERELY CUT THE LINE & PUT THE CAPACITOR IN SERIES.

Fig. 2. Partial schematic of the Pocket Mate's audio system.

off. A 4-40 hole is then tapped in the same spot. When you do this be sure to keep from twisting the base loose from the first section. Sweat soldering the base to the first section will help prevent this. A spacer is then made from any kind of metal. A 4-40 round head screw then goes through the spacer, through the antenna cotter pin and is screwed into the base of the antenna. This method of mounting provides *much* more strength than can be obtained by mounting it with the hardware supplied with the antenna.

Improving Transmit Audio

If your unit still has bassy audio, even with tape behind the speaker, try putting a .002 μF capacitor in series with the wire going to the input of the transmitter audio module (see Fig. 2). It can be placed in series with the 15k resistor at the speaker, or it can be put in the line going directly to the audio board. There is not much room, but it can be done if you have a small capacitor. If you end up not having enough audio, you may have to go to a .005 μF, although it will not limit the low frequency response as much.

Adjusting Deviation

This is just a clarification on a comment in the earlier article. Fig. 3 will assist you in locating the resistor that can be changed to determine the deviation level. Units with deviation pots usually have compression circuitry in the audio module while these usually do not. If you have one that has too much compression, the .002 μF capacitor mentioned earlier will tend to reduce it as well as limit the low frequency response.

External Antenna and Power Supply

It is possible to make good use of this radio other than using it just as a walkie-talkie. By making the appropriate connections, you can connect it to an external power supply and/or antenna (see Fig. 4). The three connections for doing this are made to the antenna block. Resistor wires (1-2 Watt) will fit the small pins, and miniature banana plugs or bent, springy wire will be useful for connection to the antenna eyelet — or you can connect an external antenna to the antenna's cotter pin with an alligator clip.

You can go one step further and connect a low impedance microphone between pins 1 or 2 (experiment to find which give the best audio) and ground, and connect the PTT line from the mike to pin 4. An external 2m amplifier can be inserted in the antenna lead between the pocket mate and the antenna; you will then have a complete, higher power, push-to-talk transceiver.

If you have gone this far, and you operate in a noisy mobile, you may want to go the last mile and plug an external 45-100Ω speaker into the earphone jack. It is located on the audio-squelch board cover, and you will need a subminiature earphone plug. It is amazing how much louder a 7.62cm — 10.16cm (3"-4") speaker sounds.

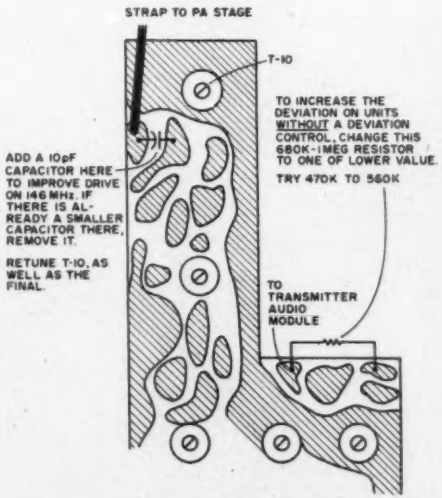
STRAP TO PA STAGE
T-10
TO INCREASE THE DEVIATION ON UNITS WITHOUT A DEVIATION CONTROL, CHANGE THIS 680K-1MEG RESISTOR TO ONE OF LOWER VALUE. TRY 470K TO 560K
ADD A 10pF CAPACITOR HERE TO IMPROVE DRIVE ON 146 MHz. IF THERE IS ALREADY A SMALLER CAPACITOR THERE, REMOVE IT.
RETUNE T-10, AS WELL AS THE FINAL.
TO TRANSMITTER AUDIO MODULE

Fig. 3. Transmitter main board.

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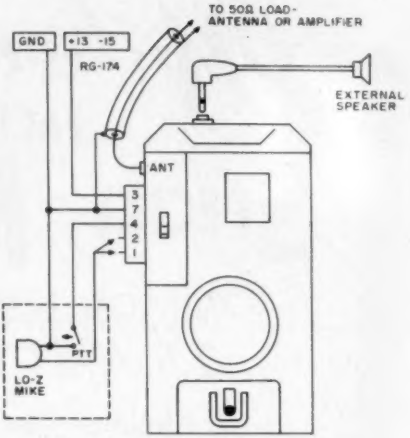

Fig. 4. External connections diagram.

For external power you can use a 13-15V battery or a suitable ac supply.

Conclusion

I hope that this has helped answer a few questions as well as assisted pocket mate owners to get the most from their units.

. . . WB4DBB

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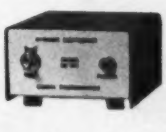

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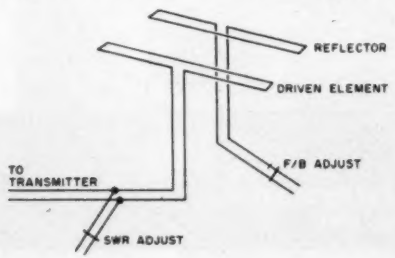
You Can Work 75m DX

With This Simple Beam

Many of us have these fantastic tri-band antennas, either beams or quads. This is a wonderful development with many savings over what we would have to do to have three separate monoband antennas. Of course, there are necessary compromises, but the advantages outweigh these for most of us.

I won't try to add to the beam vs. quad controversy, since the discussion here probably would work on each, although I've never heard of anybody trying this on a quad. Since the tri-band usually gives the choice of 14, 21 or 28 MHz, one is left to his imagination to try to do something on a lower band. Quads and their cousins have been used on the lower bands, but the physical size is somewhat prohibitive. The problem of rotation comes in if the operator contemplates something on 3.5 or 1.8 MHz.

It is possible to suspend a parasitic array between a couple trees or other supports and to have it work quite well. Living at the edge of the country, I didn't have to think too hard about the rotation problem, since at night on 3.5 or 7 MHz, everything happens to the east. So, let's build a parasitic beam!



We will construct two dipole elements making one the driven element and one a reflector. Of course, we could make one the director instead of the reflector but it seems to work out best to make the parasitic a reflector in this 2-element array. From experience I would prefer to construct these as folded dipoles because I have had quite good luck with this type antenna and the later matching procedure may be a bit easier. Furthermore, the folded dipole has much better bandwidth than an ordinary dipole. A 300Ω impedance is no problem to step up from a 75Ω line using a 4:1 balun. You can find plenty of information on lengths as well as construction information in the standard reference books.

We will set up the two elements 90° apart (or if we prefer to use the parasitic as a director, 30° spacing will work well). Feed the driven element in the regular way, matching the impedance with a shorted stub. Don't worry about unity SWR, since further adjustment will be necessary later. If you get it down below 2:1 somewhere it will be fine for right now.

You will need one of these little field intensity meters. A pair would be fine, but make sure they are matched. It is possible to make these with a little antenna, a diode, a few capacitors, and a milliammeter.

Choose two points, along the main axis of the antenna, with the center of the antenna array bisecting the line. Place a stake at each point so you can find the exact point again (or place a field intensity meter at each point). Try to get these points a reasonable distance from the array, free of obstruction to rf fields.

The idea is to adjust the shorting bar on the parasitic element for a maximum front-to-back ratio. You should easily obtain a reading of at least 3:1. Then, of course, adjust the matching bar on the driven element for minimum SWR. You may find some interaction in these adjustments, so tweak them again several times. Remember that you are not using a perfectly-conducting plane earth that the theory books assume, so there will probably be some variation from a perfect cardioid pattern.

...WA6CPP

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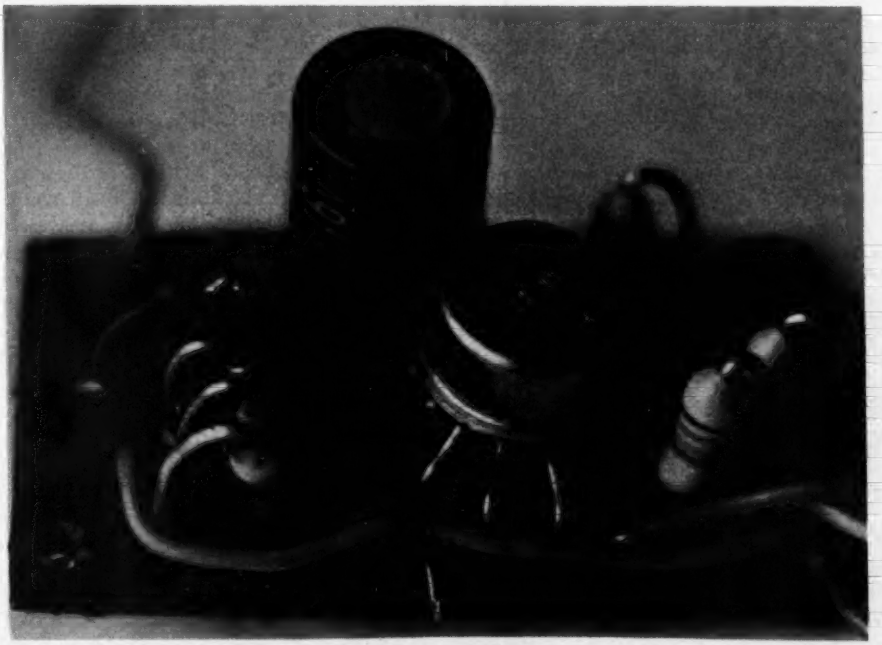
The Postage Stamp Squelcher

ICs ride again.

Need a squelch circuit for an existing receiver which has little space to add anything? If so, you may have looked over published circuits finding they include up to seven discrete transistors, some diodes and a bunch of other components, and given up on



Top view of PC board assembly.

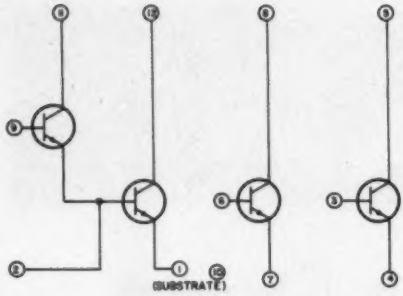


Fig. 1. Internal circuit of RCA type CA 3018 transistor array IC.

squeezing all that onto several square inches of board space.

The effective circuit described takes advantage of the RCA type CA 3018 IC transistor array and a few ¼ Watt resistors and ceramic capacitors, on a PC board measuring 2 cm x 3.5 cm – about the size of a commemorative postage stamp. If you have watchmaker patience it might even be made smaller.

This little squelch adapter will work well with any solid state receiver incorporating discrete transistor audio amplifier and driver stages, be it commercial or home brew. I included it in a small AM/FM/police band radio which lacked squelch for the latter band. Squelch operation is comparable with commercial communication equipment.

Fig. 1 is the basic circuit of the RCA CA 3018 which contains four NPN transistors in a 12 pin, M0-006-AG can. Two of the transistors are internally connected in a Darlington pair, the other two being independent. Only three of the transistors are utilized – the first as a noise amplifier, and the second as a dc bias control for the third, which acts as a switch for af stage voltages in the existing receiver. Other transistor arrays, such as the CA 3086, will function as well with pin variations.

Fig. 2 is the complete squelch circuit. Note that in my version the squelch control, R1, and noise filter components C1 & L are shown external to the PC board. R1 is front panel mounted. C1 & L values provide a high pass roll-off at 6 kHz for the transistor input load of approximately 1k. L is a miniature 15 mH toroid coil.

Fig. 3 shows connection of the squelch adapter to the audio stages of a typical receiver. Note that this circuit has a positive supply voltage ground, common in many Japanese receivers using push-pull PNP output transistors. *For negative ground circuits it will be necessary to reverse the polarity of the electrolytic capacitor C6,* and C4 should be connected to the negative ground.

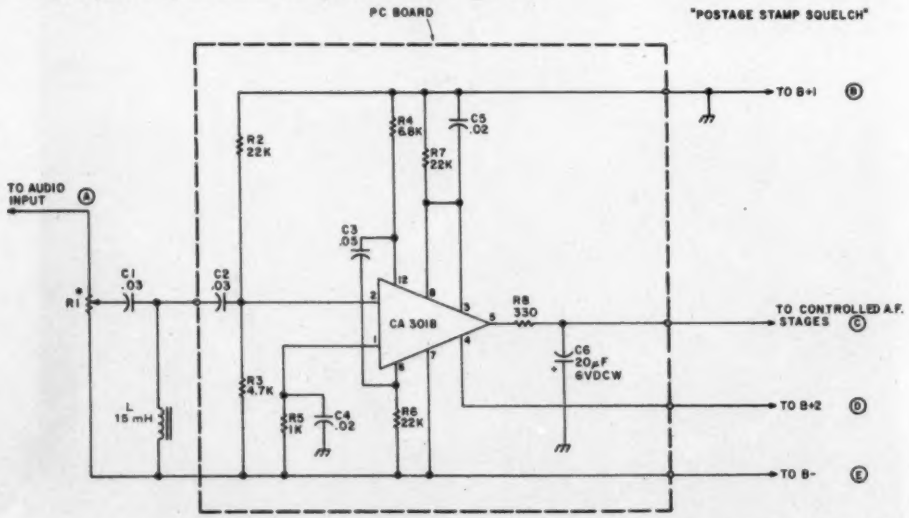


Fig. 2. Schematic of "Postage Stamp Squelch" module. Note: All capacitors uF; all resistors ¼ W.

**See text.*

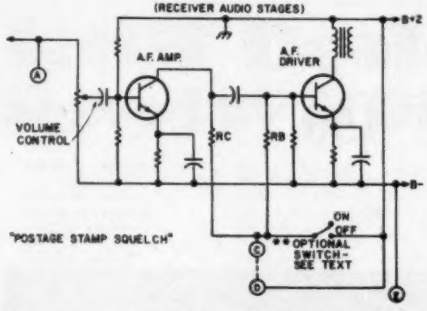


Fig. 3. Connections of squelch to typical receiver audio stages.

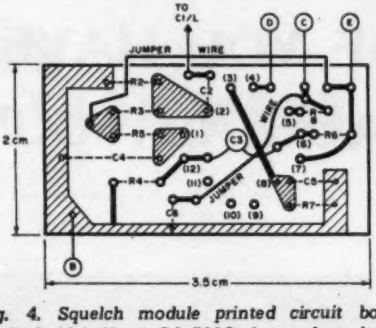


Fig. 4. Squelch module printed circuit board (etched side). Note: CA 3018 pin numbers shown in parentheses; C3 mounted on etched side.

Point A from R1 is connected via a shielded lead to input of the receiver volume control. To avoid loading the audio, R1 should have a value about five times that of the receiver volume control (e.g. for popular 10k volume controls, R1 = 50k).

The B+ connection to the receiver af amplifier collector resistor R_c, and af driver bias resistor R_b, must be broken to allow connection of points C and D shown in Figs. 2 and 3. The series connected switching transistor in the squelch adapter cuts off voltage to R_c and R_b when pure noise is present at the squelch input, muting the receiver. Both collector *and* bias voltages must be switched to obtain effective muting. It is also important that point D be connected to the original supply voltage (denoted as B+2) for the controlled stages, which is usually decoupled from the maximum receiver voltage. Point B (B+1) may be connected to the maximum voltage available, typically that supplying the audio output stages, but not exceeding +12 V dc. As low voltage supplies as 6 V for B+1 and 3.5 V for B+2 have proven adequate.

The values of the squelch output filter R8 and C6 (Fig. 2) are somewhat critical, and may require experimentation for individual receivers. R7 should be kept to a low value to minimize voltage drop. C6 must have enough capacity to prevent instability (intermittent noise pumping at threshold setting of R1) – but too large a value will result in excessive delay in squelch action, and a prolonged noise burst.

If no panel space is available for R1, this control may be internally mounted as a preset trimmer. Alternatively R1 may be eliminated and C1 connected to the receiver volume control with a series resistor with a high enough value to just effect complete squelch action. Optionally a miniature SPST switch may be connected as shown in Fig. 2, to cut the squelch on and off from the front panel.

Fig. 4 is the etched side of the 3.5 x 2 cm PC board, with location of components. Pins of the CA 3018 were spread out to allow wider spacing of connecting pads, numbered in parentheses. The ¼ Watt resistors were mounted vertically to minimize space. C3 was mounted on the underside of the board, as were the two jumper wires.

Besides being a worthwhile receiver addition, this application may generate imagination for the miniaturization of many other circuits by utilizing available IC transistor arrays.

... K6JM

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The T-278/U, Surplus Gem

Two Meter Army Boots

Recently the T-278/U VHF transmitter has become available in the surplus outlets at quite reasonable prices. The T-278/U is the transmitter module for the AN/VRC-19 VHF FM transceiver. By today's standards, it is quite bulky to be used on two meter FM. But with a few modifications, the T-278/U can be converted to 2m linear amplifier service. Output power is 50 to 60 Watts PEP when driven with a 5 Watt transverter.

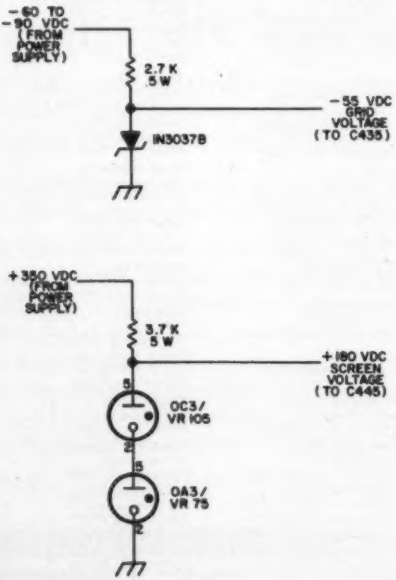
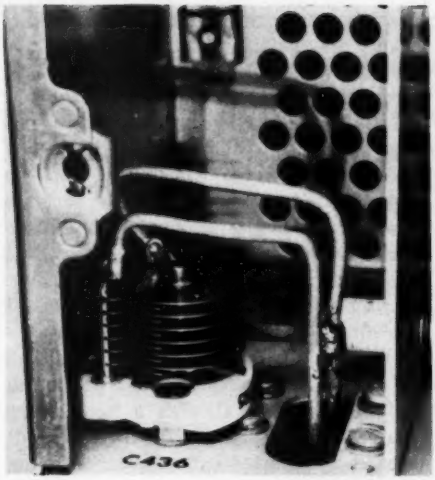


Fig. 1. Screen and control grid voltage regulator circuit for T-217/U modification.

The FM exciter is on a separate chassis within the T-278/U transmitter. The first step is to remove the exciter and add it to your junk box. The rear connector should also be removed unless one has a mating connector and desires to use it for the power supply connections. Otherwise, another plug and connector may be used or the power supply leads may simply be cabled up and connected directly to the power supply as I have done. The area vacated by the exciter is now used for the grid and screen regulators.

The schematic of the T-278/U less the exciter is on the bottom plate of the transmitter. The 2E24 driver tube is removed, as well as L408, the driver plate choke. The plate end of the driver tank coil (L409) is then bent parallel to the other end of the coil and grounded at the driver plate tuning capacitor (C436) as shown in the photo. This coil is then tapped up from ground at a point just before the coil begins to run parallel to the final grid coil. The tap is connected to a coax connector mounted on the side of the box as shown in the photo. Make this connection short and direct. A hole in the side cover will have to be made to clear the coax connector.

The final amplifier 2E24 tubes are replaced with 6146 tubes. The higher inter-



Detail of driver tank coil (L409) after modification.

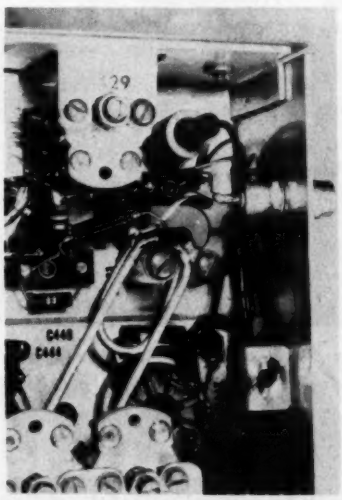
electrode capacitance of the 6146 enables the tank circuits to tune down to 144 MHz from their designed range of 152 to 174 MHz. The filament circuit to the 6146 tube sockets may have to be rewired for 6.3 V ac depending on whether your transmitter is the 6, 12 or 24 volt version. This can easily be determined by checking the schematic diagram printed on the bottom cover plate of the transmitter. Remove R444 and R443, the 33k/1 W series screen resistors, and replace the connection with a wire jumper. The grid tuning capacitors (C437 and C439) may require small padding capacitors to reach 144 MHz. Mine didn't, but the tuning peak was very close to maximum capacitance.

All wiring below the bottom chassis should be removed except the output filter and the coax cable going to it. This makes room for the regulator circuits. My power supply contained no regulated voltages for the grids and screens. Therefore, the circuit shown in Fig. 1 was installed in the rear of the chassis. The series dropping resistors will have to be different values if your supply voltages are other than those shown.

The coaxial relay on the chassis may be used as the TR relay as it is connected (provided the proper coil voltage is applied), or it may be removed and the output taken directly from the filter, or it may be simply jammed closed and the output taken from J412 (which is a type BNC connector).

Tune up is simple. Connect a suitable dummy load and apply power. Set the Tune/Operate switch to Tune and key the transmitter without drive. There should be no signs of instability. Plate current may be monitored with a voltmeter connected across the Plate Current tip jacks on the front. The reading will be 0.01 volt per milliampere of plate current (i.e., a 1.0 volt reading equals 100 mA of plate current). With no drive, there should be no plate current in Tune position and about 10 mA in the Operate position.

Next apply drive and peak the Driver Plate Tune (actually now an input tuning) and the Final Grid Tune while monitoring the plate current and/or the final grid current. An rf output indicator is very helpful if one is available for initial tune-up. Set the output coupling loop at about its midpoint, and adjust the Final Plate Tune for a dip in the plate current. Switch to the Operate position and proceed to dip the plate and load with the Output Coupling and Antenna Tuning controls. Continue until the plate current reaches about 200 mA (2 volts on the voltmeter). Then go back and touch up the other adjustments. The balance between the two tubes may be checked with



Detail of final amplifier grid tuning and rf input connector.

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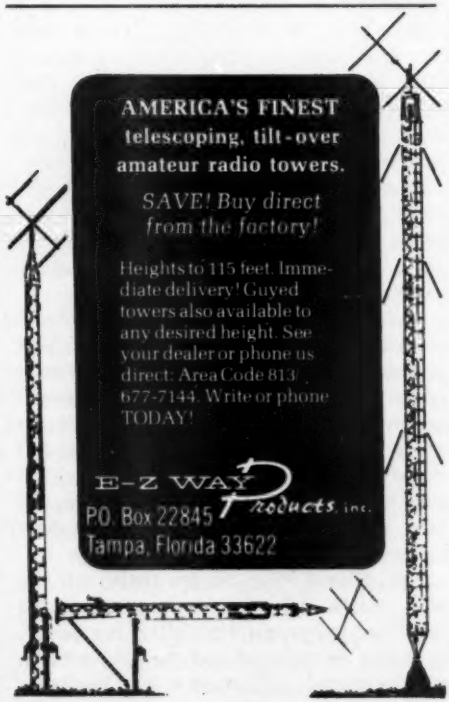
a voltmeter in the jacks labeled "BAL." Balance may be achieved by "tweaking" the grid tuning capacitors or, in extreme cases, by selecting tubes.

There are several nice features about this amplifier besides the low cost and ease of conversion. It is an ideal way for the newcomer on 2 meter SSB to generate modest power with a minimum of fuss and problems. The final tank circuit tunes the 2 meter band nicely and is of good quality. The output filter also helps to eliminate TVI problems.

This amplifier has been in use at KØDAS for about 1 year now and has performed very well. I drive it with a home brew transverter which has a 6360 in the output stage. It has performed very reliably and receives very good reports on the quality of the 2 meter SSB signal. I have used it for tropo and aurora work, but it is also ideally suited for OSCAR work. Best DX on tropo is 650 miles and 940 miles on aurora when I worked K2RTH, Long Island, New York, with 59A signal reports on both ends!

... KØDAS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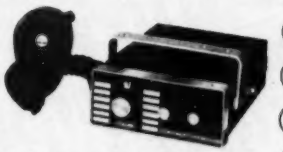

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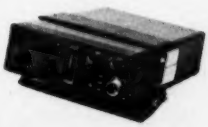

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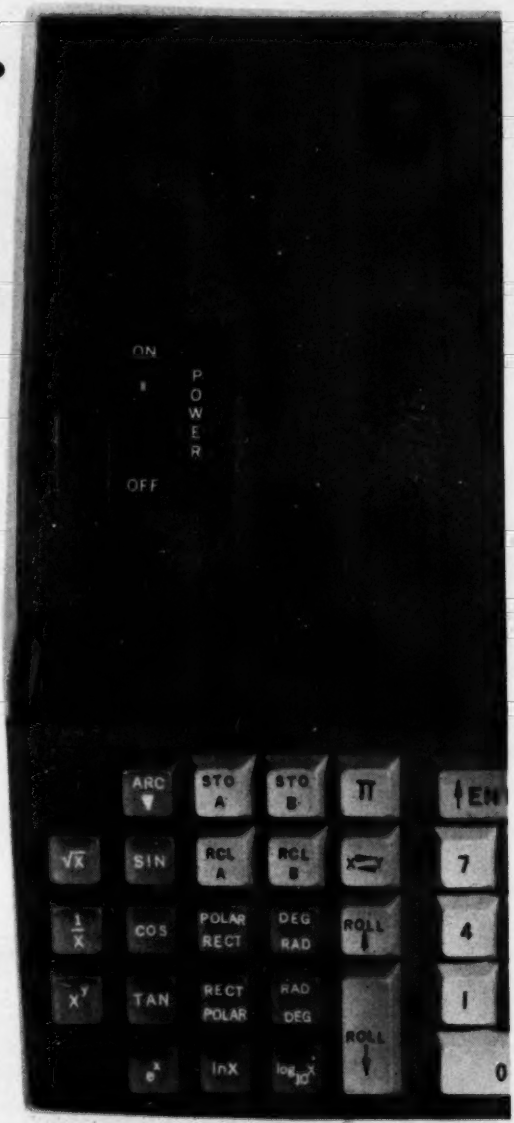

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73 Magazine Staff

Disaster in Honduras

In September, 1974, Honduras was jolted by a vicious lady named Fifi. Females of any nature, hurricane or otherwise, scorned or not, seldom have the fury brought by this unwelcome visitor. Her calling card? Thousands dead and homeless and nearly 20,000 square miles left without communications.

Needless to say, Fifi's arrival did not go unnoticed – or unanswered. Within hours, Rafael Tavares HR2RT, in La Lima, became the first radio amateur to be heard from the stricken area, and his description of the holocaust succeeded in alerting the rest of the world to the magnitude of the tragedy. Among the first to take notice – and to respond – was SIRA, the International Society of Radio Amateurs.

Left to right: Mario Paz HR1RP, Rafael Estevez WA4ZZG, Jack Goodwin VE3DPQ/W4, Jonathan Roussel HR1RT, Daniel Gomez YV5DWB/W4, Major Edmundo Alcerro (Liaison Officer), Alejandro Talbott HR1ALT, and Larry Lytle YN1LL/W4. Carlos DeFelipe LU2DZ/W4, who also flew down to Tegucigalpa, is not in the picture.

Checking and packing equipment for shipment to HRØCOPEN in Tegucigalpa. Bottom, left to right: Walkyria Picos (SWL), Larry Lytle. Top, left to right: Marta Estevez YN1ME, Rafael Estevez, Daniel Gomez.

Rafael M. Estevez WA4ZZG, SIRA's president and emergency coordinator, taped Tavares' entire transmission and played it back on a commercial station in Miami. Despite man-made as well as atmospheric interference, Friday, September 20, found members of SIRA guarding three emergency frequencies (14.205 kHz, 7.155 kHz, and

Daniel Gomez and Larry Lytle, while operating HRØSIRA/HRØCOPEN in Tegucigalpa, Honduras. Photo courtesy of the Honduran Army.

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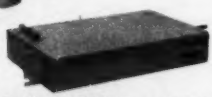

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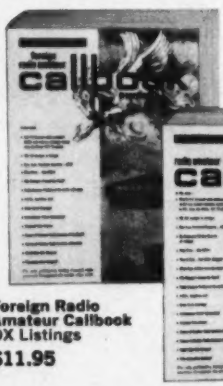

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In contact (2m FM) with a light plane over the stricken area are (left to right) Danilo Fuentes (Honduran Civil Air Patrol), Alejandro Talbott, and Rafael Estevez.

3.805 kHz) and relaying many messages to coordinate disaster relief and allay the fears of friends and relatives in the United States.

The experience gained by SIRA in December, 1972, when an earthquake destroyed Managua, Nicaragua, stood them in good stead. At that time, with the Latin Chamber of Commerce of Miami, radio station WFAB, and other civic organizations, they organized a radio marathon which produced tremendous contributions of food, money and clothing. Therefore, when they received a call from Alejandro "Alex" Talbott HR1ALT in Tegucigalpa pleading for immediate aid in the way of antennas, radio equipment, food and medicine, they were able to quickly set up another radio marathon called "Operation People to People" through radio station WQBA. Around the clock, they solicited and raised approximately $26,500 in cash and over 15 tons of food, medicine, clothing, tents and other emergency items. Not content with this effort, they then solicited the coopera-

tion of TAN Airlines, to transport the fruits of their labors to the disaster area. Finally, they sent a group of volunteers with various items of radio equipment and accessories necessary for emergency communications, which they installed and operated from station HRØSIRA in Honduras.

WQBA's radio marathon, which terminated Sunday, September 22, continued to collect donations of money, food, medicine and clothing, and the total amount realized was in excess of $43,000 cash and 500 tons of supplies (worth $2 million).

To be sure, the havoc wrought by Fifi will take a long time to untangle. The silver lining in her stormy clouds, though, was another demonstration by hams of invaluable emergency communications. And while dozens of amateurs from as many countries contributed immeasurably to the relief operation's success, the final plaudits must go to SIRA, one group which puts its time and effort where its motto is – "We foster brotherhood and good will."

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		DOUBLE	30	2.5	$18.50	$24.50
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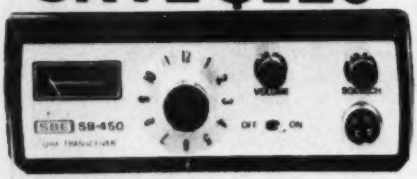

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75A-4 (ser. #5113) 449
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Galaxy V Mk III 269
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R-530 Receiver 599

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Comm III 2m 99
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HQ-215 Receiver 219
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SP-600 Receiver 175
SP-600-JX-17 275

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NCXD DC supply 75
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SB-144 2m FM Xcvr 179

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14A DC converter 29
350 Xcvr (late) 259
350C Xcvr 299
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700CX w/SS-16B 499
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14C DC module 49
512 DC supply 69
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Tempo One Xcvr $289
AC/One AC supply 75
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RX-10 Receiver $ 49
200 VFO 49
315 Receiver 169
TX-100 Transmitter 59
AC-5 antenna tuner 6
210 AC supply 19
PM-3 Transceiver 49

YAESU
FL-200B Xmtr $169
FT-101 Xcvr 499
FT-101B Xcvr 549
FTDX-401 Xcvr 449
FV-401 rem. VFO 75
FL-2100B Linear 249

12/31/74

All items subject to prior sale. Amateur Electronic Supply reserves the right to sell such items as power supplies with their matching equipment only, and not separately - depending upon our stock situation. To insure quality, our used gear is sent through our repair shops after we receive your order — so please allow for a possible slight delay (approximately 5 to 10 working days).

SAVE on Genave

Model	Reg.	Factory	NOW
GTX-10	$209	$169	$159
GTX-2	259	189	179
GTX-200	269	199	189
PS-1	79	49	48

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★ *New* ★
Clegg FM-27B
Reg. $479.
NOW $349.

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If you purchase a Metrum II on Sale as shown below — We will also sell you a PK-736 Tone Encoder kit for just $1 (reg. $45) and, or a T-1670A AC Power Supply for just $99

	reg.	Now
10 watt Metrum II	$399	$279
25 watt Metrum II	499	349

Crystals (one per channel)	9.00	PK-735 Multiple Repeater	
Repeater Offset Crystal	13.50	Offset Modification Kit	39.00
T-1670A AC Power Supply	150.00	PK-736 Tone Encoder Kit	45.00

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17929 Euclid Avenue; Cleveland Ohio Phone (216) 486–7330
621 Commonwealth Ave.; Orlando, Florida Phone (305) 894–3238

73 MAGAZINE'S GUIDE TO

Manufacturer	SBE	Tempo	Motorola	Heath	Yaesu
Model	SB-144	CL-146	Metrum II	HW-202	FT-224
Latest Price *See Mfr's specs	–	$299.00	$399.95*	$179.95	$249.00
Number of Channels	12	12	12	6	24
Size – height (inches)	2-3/8"	2.36"	2-3/4"	2-3/4"	2-3/4"
width (inches)	6-11/16"	5.9"	11"	8-1/4"	7"
depth (inches)	9-1/16"	7.66"	9-1/4"	9-7/8"	8-1/2"
Weight in lbs.	4.6	4-1/2	8	10	5.5
Power Output Hi/Low	10	15/5	25/1&10/1	10W	10/1
Rx – i-f Frequency	10.7	10.7	21.0 MHz/ 455 kHz	10.7/455	10.7 MHz
Rx – Crystal Formula (÷3 or ÷9?)	3	3	3	3	9
Crystal Capacity/Resistance	P.20	10/20	5	40Ω	28/15
Crystal Holder (HC25U?)	Yes	Yes	Yes	Yes	Yes
Padder for Receive Xtal?	No	Yes	Yes	Yes	Yes
Xtal Formula (x 12?)	x24	÷12(tx)	–	x24	x8(tx)
Crystal Capacity pF/Resistance Ohms	P.66	30/15	–	23/40	25/15
Type Channel Selector Switch	Rot.	Rot.	Rot.	P B	Rot.
Ac Input (120/240?)	No	No	No	No	No
Input Power Rec. Sq.: 12 V @ (**13.8V @)	–	.25A	.3	.2	–
Receive	.35A	.35A	–	–	0.45A
Xmt – Hi Power	2.4A	2.5A	7.5A@25W	2.2A	2.2A
Lo Power	–	.8A	3.5A@10W	–	0.7A
Mismatch Protection	Yes	Yes	Yes	Yes	Yes
Antenna Connector Type	UHF	UHF	UHF	Phono	UHF
S-Meter?	Yes	Yes	No	Yes	Yes
Power Output Meter?	Yes	Yes	No	Rel	Yes
Battery Meter?	–	No	No	No	Yes
Deviation Meter?	–	No	No	No	No
Headphone Jack?	–	No	No	No	No
Type Jack for Headphone	–	–	–	–	–
SWR Indicator?	–	No	No	–	No
Synthesizer?	–	No	No	–	No
Synthesizer kHz Steps	–	–	–	–	–
Synthesizer Repeater Offset (±600 kHz/other)	–	–	–	–	–
Accessory Plug?	No	Yes	No	No	No

2 meter FM TRANSCEIVERS

Yaesu	Ham Import Sales	Satan	Intern	Audioland	Regency	Regency	Regency
200R	KDK-144	Brimstone 144	ITC Multi-2000	Beltek WS570	HR-2B	HR-212	HR-2ms
$449.00	$399.00	$650.00	$695.00	$279.00	$229.00	$259.00	$319.00
Syn	Syn	1598tx & 1598rx	Syn	22	12	12	8
2"	2"	3-1/4"	3-1/2"	2-3/8"	2-1/4"	4"	4"
8-1/2"	6-1/2"	10-1/4"	13"	6-11/16"	5-1/2"	10"	10"
9"	7-3/4"	9-1/2"	11"	10"	7-1/2"	8-1/2"	8-1/2"
6.6	6.6	8	14	5.9	5-1/2	–	–
10/1	10W	25W	10/1	10/1	15-1	20W	20W
10.7	Syn	10.7 MHz	16.9 MHz/ 455 kHz	–	10.7/455	10.7/455	10.7/455
–	–	–	3	–	3	3	3
–	–	–	32/40	–	S-35	S-35	S-35
–	–	–	Yes	Yes	Yes	Yes	Yes
–	–	–	Yes	Yes	No	No	No
–	–	–	same as rcvr	–	18	24	24
–	–	–	–	–	32/35	32/35	32/35
Dual con-centric	3 rotary switches	Rotary decimal	3 Rot.	Rot.	Rot.	Rot.	PB
–	No	No	120 V ac	No	–	–	–
–	1.0A	1A	1.7A	–	**.18A	**.18A	**.18A
0.45A	1.2A	1.2A	1.8A	.4A	**.80A	**.8A	**.8A
2.2A	3.0A	5A	4.0A	2.5A	**3.0A	**4A	**4A
–	–	–	2.7A	.5A	–	–	–
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UHF	UHF	UHF	UHF	UHF	UHF	UHF	UHF
Yes	Yes	Yes	Yes	Yes	No	No	No
Yes	Yes	Yes	Yes	Yes(S-m)	No	No	No
No	No	No	N/R	N/A	No	No	No
No	No	No	Yes	No	No	No	No
No	No	No	Yes	No	No	No	No
–	No	–	Mini	Mini	–	–	–
No	–	No	No	No	No	No	No
Yes	Yes	Yes	Yes	No	No	–	No
10 kHz	10	5 kHz	10 kHz= RIT/VXO	N/A	–	–	No
automatic ±600 kHz	yes 600±	independent any offset	=600 kHz	N/A	–	–	–
No	Yes	Yes	Yes	Yes	No	–	–

73 MAGAZINE'S GUIDE TO

Manufacturer	Drake	Drake	Standard	Clegg	Clegg
Model	TR-22C	TR-72	826-MA	27B	FM-DX
Latest Price *See Mfr's specs	$229.95	$320.00	$398.00	$479.95	$589.95
Number of Channels	12	23	12	Syn	Syn
Size – height (inches)	7½"	2-3/8"	2-1/2"	3-1/2"	3-1/8"
width (inches)	5-3/8"	7-1/16"	6-7/8"	7-3/8"	7"
depth (inches)	2-5/16"	9-7/16"	9"	9-1/4"	10-1/2"
Weight in lbs.	3-3/4	5.5	4	4	5-1/2
Power Output Hi/Low	1W	10/1W	10/1	25W	35/1
Rx – i-f Frequency	10.7/455	10.7/455	11.7/455	4.5/455	10.7
Rx – Crystal Formula (÷3 or ÷9?)	3	3	9	–	–
Crystal Capacity/Resistance	32	32	80	–	–
Crystal Holder (HC25U?)	Yes	Yes	Yes	–	–
Padder for Receive Xtal?	No	No	Yes	–	–
Xtal Formula (x 12?)	x12	x12	18	–	–
Crystal Capacity pF/Resistance Ohms	36	36	24	–	–
Type Channel Selector Switch	Rot.	Rot.	Rot.	N/A	3 digit decade + 0/5 kHz
Ac Input (120/240?)	12 V dc	12 V dc only	option.	No	No
Input Power Rec. Sq.: 12 V @ (**13.8V @)	45 mA	.4A	.35A	.2A	1.0A
Receive	–	–	1.2A	.4A	1.2A
Xmt – Hi Power	.45	2.7A	2.4A	6.5A	9.5A
Lo Power	–	1.2A	1.5A	–	3.5A
Mismatch Protection	No	Yes	Yes	Yes	Yes
Antenna Connector Type	UHF	UHF	UHF	UHF	UHF
S-Meter?	Yes	Yes	Yes	No	Yes
Power Output Meter?	Yes	Yes	Yes	Yes	Yes
Battery Meter?	Yes	No	Yes	No	No
Deviation Meter?	No	No	No	–	No
Headphone Jack?	No	No	Yes	Yes	Yes
Type Jack for Headphone	No	No	Mini	Phono	Phono
SWR Indicator?	No	No	Yes	No	No
Synthesizer?	No	No	No	Yes	Yes
Synthesizer kHz Steps	No	No	–	Cont.	5 kHz
Synthesizer Repeater Offset (±600 kHz/other)	No	No	–	Inde-pendent	Yes plus 3 optional
Accessory Plug	No	Yes	Yes	Ext. Spkr.	Yes

2 meter FM TRANSCEIVERS

Emergency Beacon	Genave	Genave	Genave	Icom	Icom	Icom	Spectrum
EBC-144 Jr.	GTX-2	GTX-10	GTX-200	IC-230	IC-21A	IC-22	560
$599.00	$189.95	$169.95	$199.95	$489.00	N/A	$249.95	$180.00
Syn	10	10	10	Syn	24	22	6
2-3/4"	2-1/2"	2-1/2"	2-1/2"	2-1/4"	4-3/8"	2-1/4"	2-1/4"
6-1/2"	6-1/2"	6-1/2"	6-1/2"	6-1/8"	9"	6-1/8"	6"
9"	10-3/4"	10-3/4"	10-3/4"	8-1/2"	11"	8"	8"
5	3	3	3	5-1/2	14-1/2	3-3/4	N/A
20W	30W	10W	30W	10W	10/1	10/1	5W
10.7	13.1	13.1	13.1	10.7/455	10.7/455	10.7/455	10.7
–	3	3	3	–	9	9	÷3
–	39/30	39/30	39/30	–	20/15	20/15	32
–	Yes	Yes	Yes	–	Yes	Yes	Yes
–	No	No	No	–	Yes	Yes	Yes
–	x12	x12	x12	–	8	8	x12
–	20/30	20/30	20/30	–	20/15	20/15	36
TW	PB	Rot.	Rot.	Rot.	Rot.	Rot.	Rot.
No	No	No	No	No	Yes	No	No
1.0A	.15A	.15A	.15A	.2A	.2	180	90mA
1.5A	.25A	.25A	.25A	.4A	.4	350	–
7.0A	6A	2A	6A	2.4A	2.1	2.0	.9A
–	2A	–	2A	N/A	1.2	.9	–
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
UHF	UHF	UHF	UHF	UHF	UHF	UHF	UHF
Yes	No	No	No	Yes	Yes	Yes	No
Yes	No	No	No	Yes	Yes	Yes	No
No	No	No	No	No	No	No	Yes(LED)
No	No	No	No	No	Yes	No	No
Yes	No	No	No	No	Yes	No	No
Mini	1/4"	–	1/4"	Mini	No	No	No
–	No	No	No	No	Yes	No	No
Yes	No	No	No	Yes	No	No	No
5 kHz	–	–	–	30	No	No	No
any offsets	–	–	–	Yes±6	No	No	No
No	No	No	No	Yes	No	No	No

Which 2m Rig For YOU?

Amateurs are forever calling up 73 Magazine and asking what FM transceiver they should buy. Is this one any good? Is that one any good? The answers sometimes are not comfortably clear cut, and often reduce to another simple question: What do you want in an FM rig?

You have to decide whether you can get along with six channels . . . with twelve . . . or, perhaps, if it is worth it to get all the channels — which means a synthesized rig. Do you really need more than 24 channels? Will you want a combination walkie-talkie and mobile rig? Or are you looking for a rig just to use at home? Do you want to be able to use the same rig for FM and for working sideband . . . perhaps via the Oscar satellites? How important is ac power for you? How much do you want to spend?

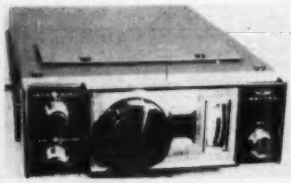
The last question answers many of the others, for it is a good general rule that the more doodads you want on your rig, the more it is going to cost. Some amateurs figure that the actual cost of a rig is about half the price they pay, since they will probably be able to sell it for about half price in a couple of years, when they move on to a newer rig. At least it could be worth half price if it is still in good shape — some amateurs have a dustbin complex and turn any piece of new gear into WWII surplus in a week.

With few exceptions the rigs listed have been tested at 73 HQ. (No tests have yet been possible on the Brimstone, and only a prototype of the EBC Jr has been wrung out.) The new Clegg FMDX is not yet available, nor the KDK — watch for data on these in later issues, as they become available and are checked out.

A word to manufacturers, if there are any gripes on the guide: We really tried to make it accurate. It took months to finally wring info and pictures from everyone — and still we had to piece things together from ads or old spec sheets in some cases. If it is this difficult for the 73 staff to round up this data, imagine how impossible it would be for the average reader! The guide may not look like a big deal, but it took weeks of work for five people and you-wouldn't-believe-how-many phone calls. Enjoy . . . please.

AUDIOLAND

Audioland
36633 S. Gratiot
Mt. Clemens MI 48043



BELTEK-W5570

- 22 channels
- Output power of 10 Watts or 1 Watt
- S-meter and power output meter
- Dimensions: 2.38" H x 6.66" W x 10" D
- Weight: 5.9 lbs
- Price: $279.00

CLEGG

Clegg Division,
International Signal & Control Corp.
3050 Hempland Road
Lancaster PA 17601

27B

- Synthesized channels
- Power output of 25 Watts
- Full independent transmit
- Receive coverage 146-148 MHz with 1 kHz resolution
- No repeater offset or channel spacing limitations
- Discriminator meter
- Mobile mount with locking device
- Dimensions: 3.50" H x 7.38" W x 9.25" D
- Weight: 4 lbs
- Price: $479.95

FM-DX

- Synthesized channels
- Power output of 35 Watts or 1 Watt
- Frequency coverage: 143.5 — 148.5 MHz
- Intermod atten: >66 dB
- LED numeric frequency display (6 digits)
- Modular construction

- Dimensions: 3.13" H x 7" W x 10.5" D
- Weight: 5.5 lbs
- Price: $589.95

DRAKE

R. L. Drake Company
540 Richard Street
Miamisburg OH 45342

TR-72

- 23 channels, 2 supplied
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 through 148 MHz
- Dimensions: 2-3/8" H x 7-1/16" W x 9-7/16" D
- Weight: 5.5 lbs
- **Price: $320.00** *(Including Dynamic microphone, DC power cord, four position mobile mounting bracket, desk mount stand, microphone, hanger, auxiliary connector plug and external speaker plug.)*
- *Accessories: AC-10 power supply @ $44.00*

TR-22C

- 12 channels, 2 supplied
- Output power of 1 Watt minimum
- Frequency range: 144 through 148 MHz
- Monolithic crystal filter in i-f for superior adjacent-channel selectivity
- Improved microphone
- Dimensions: 7.5" H x 5.38" W x 2.31" D

- **Price: $229.95** *(Including mike, over-the-shoulder carrying case, 120 V ac and 12 V dc cords, 10 ni-cad batteries, and speaker/headphone plug.)*
- *Accessories: AC-10 power supply — $44.00, AA-10 10W amplifier — $49.95*

EMERGENCY BEACON

Emergency Beacon Corp.
13 K River Street
New Rochelle NY 10801

EBC-144 Jr.

- Synthesized channels
- Output power of 20 Watts
- Frequency range: 143.5 MHz to 148.5 MHz in 5 kHz increments
- Synthesizer flexibility that offers a choice of 600 kHz offsets up or down, automatically selected for standard channel spacing

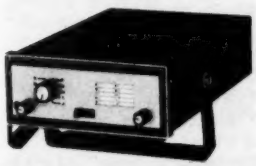
- Reverse simplex and frequency split allowing totally independent receive and transmit frequencies
- Dimensions: 2.75" H x 6.50" W x 19" D
- Weight: 5 lbs
- **Price: $599.00**

GENAVE

General Aviation Electronics, Inc.
4141 Kingman Drive
Indianapolis IN 46226

GTX-10

- 10 channels
- Output power of 10 Watts
- Simple conversion to 30 Watt output
- Easily cross-wired for duplex crystal operation
- Transmit indicator light
- Perfect for portable operation with HamPak



- Dimensions: 2.5" H x 6.5" W x 10.75" D
- Weight: 3 lbs
- **Price: $169.95**
- *Accessories: Touch Tone Encoder — $59.95, Subaudible Tone Encoder — $19.95, AC Power Supply $49.95, Battery and Antenna Package (less batteries) $29.95, Battery and Antenna Package with 60 Watt hour rechargeable battery — $124.95*

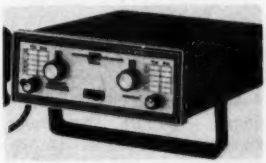
GTX-2

- 10 channels
- Output power of 30 Watts
- Push-button channel selection
- Rear panel external speaker jack
- Backlighted for night operation
- Transmit indicator light
- Perfect for mobile operation

- Dimensions: 2.5" H x 6.5" W x 10.75" D
- Weight: 3 lbs
- **Price: $189.95**
- *Accessories: Same as those available with GTX-10*

GTX-200

- 10 channels
- Output power of 30 Watts
- Separate controls for independent transmit and receive frequency selection
- Switch for lock-in of pre-selected frequency pairs allows one-knob operation
- Rear panel external speaker jack
- Backlighted for night operation



- Dimensions: 2.5" H x 6.5" W x 10.75" D
- Weight: 3 lbs
- **Price: $199.95**
- *Accessories: Same as those available for GTX-10*

HAM IMPORT SALES

Ham Import Sales
P.O. Box 1009
Blaine WA 98230

KDK-144

- Synchronized channels

- Output power of 10 Watts
- S-meter and power output meter
- LED readout
- 1 memory channel set at 146.52
- Accessory plug for tone access
- Dimensions: 2" H x 6.50" W x 7.75" D
- Weight: 6.6 lbs
- **Price $399.00** *(Including microphone, mounting bracket, and power cord)*

HEATH

Heath Company
Benton Harbor MI 49022

HW-202

- 6 channels
- Output power of 10 Watts
- All plug-in crystal channels
- Dimensions: 2.75" H x 8.25" W x 9.88" D
- Weight: 10 lbs
- **Price: $179.95(in kit form only)**
- ***Accessories: AC power supply — $29.95, Tone Burst Encoder — $24.95, Mobile Antenna — $19.95, Fixed Station Antenna — $17.95, VHF wattmeter — $34.95, PWR Amplifier — $69.95***

ICOM

ICOM
Division of ACS, Inc.
Box 331
Richardson TX 75080

IC-230

- Synthesized channels
- Output power of 10 Watts
- Frequency coverage: 146 — 148 MHz
- Quick disconnect mobile mount
- Modular construction

- Dimensions: 2.25" H x 6.13" W x 8.50" D
- Weight: 5.5 lbs
- **Price: $489.00**

IC-22

- 22 channels mobile
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 to 148 MHz

- 5 channels supplied
- Input strength and output power indication on a meter
- No relays to wear
- COR light shows receiver signal without audio being on
- Dimensions: 2.25" H x 6.13" W x 3.75" D
- Weight: 3.75 lbs
- **Price: $249.95**

IC-21A

- 24 channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144.00 to 148.00 MHz
- Discriminator meter — S-meter/power output meter
- Netting switch for calibration

- Dimensions: 4.38" H x 9" W x 11" D
- Weight: 14.5 lbs
- **Price: N/A**

INTERNATIONAL

International Telecommunications Corporation
P.O. Box 4235
Torrance CA 90510

ITC Multi-2000

- Synthesized channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 — 148 MHz possible with RIT and VXO continuous
- Output power adjustable with internal controls from 0 W — 15 W, all modes
- Multi-mode 2m transceiver: CW/SSB/NBFM/WBFM
- Dimensions: 3.5" H x 13" W x 11" D
- Weight: 14 lbs
- **Price: $695.00**

MOTOROLA

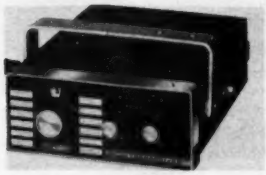
Motorola Corporation
Amateur Radio Division
Phoenix AZ

Metrum II

- 12 channels
- Output power of either 25 W/1 W or 10 W/1 W
- Reverse polarity protection
- Provision for external speaker
- Only one crystal required per channel
- Crystals supplied for 146.94
- Reversible control panel and mounting tray for ease of installation in various positions
- Dimensions: 2.75" H x 11" W x 9.25" D
- Weight: 8 lbs
- **Price: 25 Watt — $499.95, 10 Watt — $399.95**

REGENCY

Regency Electronics, Inc.
7707 Records Street
Indianapolis IN 46226

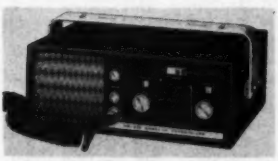


HR-2B

- 12 channels
- Output power of 15 Watts or 1 Watt
- Frequency range: 144 – 148 MHz
- All plug-in crystal channels
- Audio output of 3 Watts
- Dimensions: 2.25" H x 5.50" W x 7.50" D
- Weight: 5.5 lbs
- **Price: $229.00** *(Including plug in ceramic mike, mounting bracket and transmit and receive crystals for 146.94 MHz)*

HR-212

- 12 channels
- Output power of 20 Watts
- Frequency range: 144 – 148 MHz



- Mode switch enables pre-determined or independent paired frequency transmit and receive operation
- Dimensions: 4" H x 10" W x 8.50" D
- **Price: $259.00** *(Including plug-in ceramic mike, mounting bracket and factory installed transmit and receive crystals for 146.94 MHz)*

HR-2MS

- 8 channels
- Output power of 20 Watts
- Frequency range: 144 – 148 MHz
- Receiver automatically scans 8 channels for active signals

- Readout lights detail search
- Transcan locks on and hears entire transmission
- Push buttons for each of the 8 transmit channels
- Dimensions: 4" H x 10" W x 8.5" D
- **Price: $319.00**

SATAN

Satan Electronics, Inc.
R.R. 3 Box 38A
Salina KS 67401

Brimstone 144

- All channels
- Output power of 25 Watts
- Frequency range: 143.00 to 149.99 MHz in increments of 5 kHz
- Backlit front panel
- Durable foam vinyl covering on cabinet
- All solid-state with plug in modules
- Dimensions: 3.25" H x 10.25" W x 9.50" D
- Weight: 8 lbs
- **Price: $650.00**
- *Accessories: Touch Tone – $18.95, sub-audible PL continuous tone – $18.95, dial tone – $18.95, Tone Burst – $28.50, 142 MHz coverage – $15.00*

SBE

SBE Linear Systems, Inc.
220 Airport Blvd.
Watsonville CA 95076

SB-144

- 12 channels
- Output power of 10 Watts
- All plug in crystal channels
- S-meter and power output meter
- Dimensions: 2.38" H x 6.69" W x 9.06" D
- Weight: 4.6 lbs
- **Price: N/A**

SPECTRUM

Spectrum Communications
Box 140
Worcester PA 19490

MODEL 560

- 6 channels
- Output power of 5 Watts
- Frequency range: 146 to 148 MHz
- Built-in 3" speaker
- Front panel LED pilot light doubles as accurate battery voltage indicator
- Front and rear panel antenna jacks
- Dimensions: 2.25" H x 6" W x 8" D
- **Price: $180.00**
- *Accessories: 120 V P.S. – $45.00, 25 W Amp/preamp – $89.00, Battery and charger – $69.00, Mounting Bracket – $8.00*

STANDARD

Standard Communications
639 North Marine Avenue
Wilmington CA 90744

826 MA

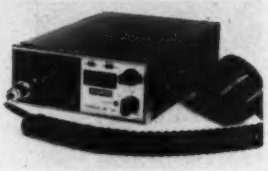
- 12 channel
- Output power of 10 Watts or 1 Watt
- Frequency range: 143 to 149 MHz
- Completely solid-state
- Enclosed in a splash-proof, weather-resistant case
- Built-in loudspeaker, microphone, line filter, universal mounting bracket and

factory installed crystals for four popular channels

- Dimensions: 2.50" H x 6.88" W x 9" D
- Weight: 4 lbs.
- **Price: $398.00**
- *Accessories: AC supply — $56.00, external speaker — $17.00, portable battery pack — $34.00, tone squelch board — $81.50, solid-state tone squelch board — $95.50, replacement microphone connector — $3.00, replacement dc power cable — $1.25, transceiver mounting bracket for mobile — $3.00*

TEMPO

Henry Radio
11240 West Olympic Blvd.
Los Angeles CA 90064



CL-146

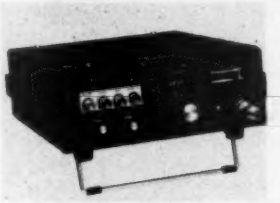
- 12 channels
- Output power of 15 Watts or 5 Watts
- Frequency range: 144 to 148 MHz
- RF output meter, S-meter, receiver detector meter
- Audio output at front panel
- Internal speaker — Dynamic high impedance microphone
- Dimensions: 2.36" H x 5.90" W x 7.66" D
- Weight: 4.5 lbs
- **Price: $299.00**

YAESU

Yaesu Musen USA, Inc.
7625 East Rosecrans Avenue
Paramount CA 90723

FT-224

- 24 channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 to 146 MHz or 146 to 148 MHz
- Discriminator/S-meter
- "Call" or priority channel
- Supplied with 3 channels
- External speaker jack
- Dimensions: 2.75" H x 7.08" W x 8.66" D
- Weight: 5.5 lbs
- **Price: $249.00**



SIGMASIZER-200R

- Synthesized channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 to 146 MHz or 146 to 148 MHz
- Priority channel overrides main channel selector
- External speaker jack
- Dimensions: 3.15" H x 8.66" W x 9.05" D
- Weight: 6.6 lbs
- **Price: $449.00**

CASHAROONIE

Money! You can get top dollars now for U.S. surplus electronics, particularly Collins. Write or call now for your bigger than ever quote. Space Electronics Corp., 76 Brookside Ave., Upper Saddle River, N.J. 07458 (201) 327-7640.

PL-259
SO-239
COAKIT

Either Plugs OR Sockets
5 for $3.50 POST-PAID
N.J. residents add 18c Sales Tax
Send SASE for other Connectors.
P.O. Box 101-A, Dumont, N. J. 07628

MINIATURE SUB-AUDIBLE TONE ENCODER

- Compatible with all sub-audible tone systems such as Private Line, Channel Guard, Quiet Channel, etc.
- Glass Epoxy PCB, silicon transistors, and tantalum electrolytics used throughout
- Any miniature dual coil contactless reed may be used (Motorola TLN6824A, TLN6709B – Bramco RF-20)
- Powered by 12vdc @3ma
- Use on any tone frequency 67Hz to 250Hz
- Miniature in size 2.5x.75x1.5" high
- Wired and tested $14.95
- Complete less reed (Available in 33 freqs. for $17.50 ea)
- Output 3v RMS sinewave, low distortion
- Postpaid — Calif. residents add 5% sales tax

COMMUNICATIONS SPECIALISTS
P.O. Box 153, Bree CA 92621

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5200 Panama Ave., Richmond CA USA 94804

THE ONLY QSL BUREAU to handle all of your QSLs to anywhere; next door, the next state, the next county, the whole world. Just bundle them up (please arrange alphabetically) and send them to us with payment of 6¢ each.

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... then build a TV camera!

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Vhf engineering

— DIV. of BROWNIAN ELECTRONICS CORP. —

320 WATER ST. P.O. BOX 1921 BINGHAMTON, NY 13902 607-723-9574

MINI-CATALOG 1975

THE WORLD'S MOST COMPLETE LINE OF VHF—FM KITS AND EQUIPMENT

CD1 Kit	10 channel receive xtal deck w/diode switching		**$ 6.95**
CD2 Kit	10 channel xmit xtal deck w/switch and trimmers		**$14.95**
COR2 Kit	complete COR with 3 second and 3 minute timers		**$19.95**
SC2 Kit	10 channel auto-scan adapter for RX		**$19.95**
TX144 Kit	exciter—1 watt—2 meters		**$29.95**
TX220 Kit	exciter—1 watt—220 MHz		**$29.95**
TX432 Kit	exciter—**NEW**—432 MHz		**coming soon**
RX144/220 F Kit	140-170 or 210-240 MHz rcvr w/8 pole cer 455 filter		**$65.95**
RX144/220 C Kit	140-170 or 210-240 MHz rcvr w/2 pole 10.7 xtal filter		**$69.95**
RX432 C Kit	**NEW**—432 MHz receiver		**coming soon**
HT144 B Kit	2 meter—2w—4 channel—hand held xcvr		**$129.95**
PA1501H Kit	2 meter pwr amp—15w—compl. kit w/SS switching		**$49.95**
PA2501H Kit	similar to above—24w		**$59.95**
PA144/15 Kit	similar to PA1501H less case, connectors and switching		**$39.95**
PA144/25 Kit	similar to above—25w		**$49.95**
PA220/15 Kit	similar to PA144/15 for 220 MHz		**$39.95**
PA432/10	**NEW**—similar to PA144/15 except 10w and 432 MHz		**coming soon**
PA4010H Kit	10w in—40w out—relay switching		**$59.95**
PA110/10	10w in—110w out 2 meter amp	factory wired	**$179.95**
PA110/30	30w in—110w out 2 meter amp	factory wired	**$149.95**
PS3 Kit	power supply regulator card		**$ 8.95**
PS12C Kit	12 amp—12 volt regulated power supply w/case		**$69.95**
PS24C Kit	24 amp—12 volt regulated power supply w/case		**$99.95**
RPT144	**NEW**—15 watt—2 meter repeater	factory wired	**$595.95**
RPT220	**NEW**—15 watt—220 MHz repeater	factory wired	**$595.95**
RPT432	**NEW**—10 watt—432 MHz repeater		**coming soon**

Repeaters are available in kit form—write for prices

SEE YOU AT DAYTON !

ITEM	PART #	DESCRIPTION	PRICE	EXTENSION

NAME _____ TOTAL _____

ADDRESS _____ SHIPPING _____

CITY _____ NYS RESIDENTS-SALES TAX _____

STATE _____ ZIP _____ TOTAL ENCLOSED _____

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Latest FCC News
(from inside the FCC)
Latest Docket Releases
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Hotline overcomes the two month news delay of 73 Magazine (and all other ham magazines) by bringing you the latest hot news while it is still news. This puts you in the know on the air — over the repeater — and at your ham club.

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73 MAGAZINE, Peterborough NH 03458

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ONLY .50¢

Ham radio is too great a hobby for us to keep it to ourselves. Let's tell the whole world about it! And what better way than by sporting this attractive lime-green bumper sticker on your car! It's only 50¢ — and it's phosphorescent so you can see it even at night. Go ahead . . . SPREAD THE WORD! Order yours TODAY!

Spread the Word Bumper Sticker
73 Inc., Peterborough NH 03458

Name _____

Address _____

City _____ State _____

Call _____ Zip _____

Voxpoop

While we are to some extent a prisoner of the authors of the articles — if they don't write them we can't print them — still we do like to know your reaction to what we do publish so we can keep trying to bring you what you enjoy the most. In the interests of science then, please let us know which articles you enjoyed the most and which you disliked most. The author of the article with the most votes will get a check for $50 extra to encourage him to get busy and write more.

WOW!

UGH!!

VOXPOOP, 73, Peterborough NH 03458

All Robot Model 70A Monitors Now at

SPRING CLEARANCE SALE PRICES!

Not to be outdone by the auto companies, Robot is reducing the price of our Model 70A Monitor to only $295, while supply lasts.

We're offering this outstanding value to beat inflation and to clear our inventory so we can increase production of our new Model 70B "3 in 1" Monitor.

Buy one of our 70A Monitors now at this reduced price with our money back guarantee. If you get hooked on SSTV like thousands of other SSTV operators, and you want to go the whole way, you can add a 70B conversion kit later for only $99, or have it factory installed for $145.

At these prices, you can't lose. But don't wait. Quantity is limited.

Please send me the following Robot equipment. I understand that if I am dissatisfied for *any* reason, I can return the units and receive a full refund.

- ☐ Model 70A at the reduced price of $295
- ☐ The new Model 70B Monitor at $445
- ☐ Model 80A SSTV Camera at $345

Name _____ Call _____

Address _____

City _____

State _____ Zip _____

ORDER FACTORY DIRECT TODAY

ROBOT

ROBOT RESEARCH, INC.
7591 Convoy Court
San Diego, California 92111
Phone 714-279-9430

FRESNO CA
MAY 2-4

The 1975 Pacific Division American Radio Relay League Convention will be held on May 2-4 at the Sheraton Inn in Fresno. Judging from past turnouts we can expect between 500 and 600 registered delegates and 100 to 200 non-registered hams. Rooms are single, $17; double, $20; and suites, $35. Limited number of rooms available — they must be reserved through the convention committee. For more information contact: Berge Bulbulian WB6OSH, Exhibit Chairman, Fresno Amateur Radio Club, Inc., P.O. Box 783, Fresno CA.

SAN DIEGO CA
MAY 2-4

This year's West Coast VHF Conference will be held at the Sheriden Inn on Harbor Island in San Diego on May 2-4, 1975. Tech talks are sked for Sat. 3rd, from about 9 am to 5 pm; prize drawing; Noise Figure contest Sat evening; Antenna measuring contest Sun am. Pre-reg is $2.50, hotel accomos are $21 single, $27 dbl. More info will be sent later to those on our mailing list. Those who don't get one should drop a line for info sheet, etc, to Louis N. Anciaux WB6NMT, Spec Comm Sys, 4519 Narragansett Ave, San Diego CA 92107.

CADILLAC MI
MAY 3

The Wexsaukee Radio Club announces their 15th annual Swap-Shop and Eye-Ball that will be held May 3rd in the National Guard Armory in Cadillac, Michigan starting at 9 am. This Swap-Shop is open to all radio amateurs, CBers and anyone interested in radio communications. Lunches will be available at noon and there is lots of free parking. Tickets available at the door. All are invited.

CONNECTICUT QSO PARTY
MAY 3-5

Contest period 2100 GMT May 3 to 0200 GMT May 5. Certificates to highest scorer in each ARRL section or Province and each Connecticut county. Special — Worked All Connecticut Counties certificate. Trophy to highest scoring club entry. For info write Candlewood Amateur Radio Assn., c/o Donald Crosby W1EJM, 10 Royal Rd., Danbury, Conn. 06810.

WESTMINSTER MD
MAY 4

The Potomac Area VHF Society will hold their Annual hamfest on Sunday, May 4, 1975, at the Agricultural Center in Westminster, Maryland between the hours of 9 am to 5 pm. There will be a registration of $3. Talk-in will be on 146.94 & 52. For information contact K3DUA or WA3NZL.

GREENVILLE SC
MAY 4

The Blue Ridge Radio Society's annual Hamfest will be held Sunday, May 4, 1975. Same location as in past years at Cleveland Park in Greenville, South Carolina. Prizes, flea market, bingo. Talk-in on 146.01/61.

ST PETERSBURG FL
MAY 4

The St. Petersburg, Florida, Amateur Radio Club (SPARC) will hold their annual Hamfest at Lake Maggiore Park, Sunday, May 4, 1975. Tables will be available for sales or trading of used and Home brew equipment as well as home-made Arts and Crafts items.

GEORGIA QSO PARTY
MAY 10-12

Starts: 2000 GMT, Saturday, May 10, 1975
Ends: 0200 GMT, Monday, May 12, 1975

The 14th annual Georgia QSO Party is sponsored by the Columbus Amateur Radio Club, Inc. There are no time or power restrictions and contacts may be made once on phone and once on CW on each band with each station.

For further info contact John T. Laney, III, K4BAI, P.O. Box 421, Columbus GA 31902.

LAKE DELTON WI
MAY 17

The Yellow Thunder 5th Annual Hamfest will be held Saturday May 17, 1975 at the Dellview Hotel in Lake Delton WI. Indoor and outdoor swap areas, 146.94 hidden transmitter hunt, ladies activities, liar's contest, VHF Repeaters, RTTY and much more. Tickets $1.50 in advance/$2.00 at door; $6.50 in advance includes reg., activities and banquet/$7.00 at door. Mail reservations to J. P. Anderson WB9EWR, 624 14th St., Baraboo WI 53913. Talk-in on 146.94 MHz.

DURHAM NC
MAY 17-18, 1975

Durham F.M. Association proudly presents its annual Hamfest, flea-market and F.M. Convention, Saturday and Sunday, May 17-18, 1975. Downtown Ramada Inn, Durham NC. Advanced registration $2.00 — $3.00 at door. Children free. Saturday night banquet — res. $11.00. For info write: Durham F.M. Association, Inc., P.O. Box 8651, Durham NC 27707.

BURBANK CA
MAY 17-18

This year's W6LS Hamfest will be held at W6LS on the weekend of May 17-18. Saturday 10 am — 5 pm; Sunday 10 am — 4 pm. Contests, indoor/outdoor displays of ham gear and accessories, technical presentations, prizes and free parking. Tickets $2; children 12 and under, free. Key people: Ray Biederman WB6NSJ — booths; Ed Satchell WB6MHE — speakers; Dave Cox WA6BIO — tickets.

CEDAR POINT OH
MAY 18

Vacation Land Hamfest Sunday, May 18, 1975. Erie County Fairgrounds near Cedar Point. Huge flea market area. First prize — Regency HR-2B. Tickets — $1.00 advance, $1.50 at gate. Information: Hamfest, P.O. Box 2037, Sandusky OH 44870.

TRENTON TN
MAY 18

The Annual Humboldt ARC Hamfest is Sunday May 18 at Shady Acres City Park, Trenton, Tennessee. Flea market, ladies activities and playground. Contact Hugh Wardlaw WB4SLI, 2678 Cole Drive, Humboldt TN 38343.

BILLINGS MT
MAY 18

Yellowstone Radio Club will hold their annual picnic and an auction. Pot luck and clean out your junkbox. Talk-in on 3910 kHz and 146.94 simplex.

BRONX NY
MAY 18

The Bronx County Historical Society will sponsor a special events stations on Bronx Bicentennial Day, Sunday, May 18. The call requested is KT2BBC. We will operate on 40 meters, phone and CW; 20 meters phone and CW; and 2 meter FM. The Novice bands will be kept active on 40. We want to make as many contacts as possible and ask that all hams look for us. All QSL card

collectors will receive special cards with an SASE or a stamp to M. Alpert, 2425 Fish Avenue, Bronx, New York 10467. Cards from SWLers are also welcome.

Those interested in ham radio can get information on amateur radio licensing at the station.

The operation will be all day Sunday and area hams are invited to come and enjoy the events, shows and exhibits in Van Cortland Park in the Bronx.

WEST LIBERTY OH
MAY 18

The Champaign Logan Amateur Radio Club will hold their annual flea market and auction May 18, 1975 at 12 pm at the West Liberty Lions Park, West Liberty OH. Talk-in on 146.52 and 146.13/73.

IRVINGTON NJ
MAY 18

The Third Annual Irvington Radio Amateur Club Hamfest will be held this year on Sunday, May 18, 1975 at 1:00 pm, in the Irvington P.A.L. Building, 285 Union Avenue (exit 143 on Garden State Parkway North, exit 143b on Parkway South). Door prizes include Drake TR22C, mobile 2 meter power amp, mobile 2 meter gain antenna, plus much more. Admission $1.00, tables $2.50. For advance sale or more info contact WA2PWZ, WA2QQV or WB2SRY. Talk-in on 146.94, 146.52.

WABASH IN
MAY 18

Wabash County Amateur Radio Clubs 7th Annual Hamfest, May 18, 1975 4-H Fairgrounds, Wabash, Indiana. Advance admission $1.00 per person ($1.50 at the gate). Time 7 - 4 pm. Major drawing $1.00 donation per ticket. Hourly prizes 10 am - 2 pm. Technical sessions, large flea market, prizes for: Oldest and youngest ham, ham furthest from home QTH. Free all-night camping, tables available, coffee & donuts. Call-in on Simplex 94-94, 28-88, repeaters 146.13-73, 14763-03. For further information contact: Bob Mitting WB9DKH, 663 N. Spring Street, Wabash IN 46992.

KNOXVILLE TENN
MAY 24-25

The Radio Amateur Club of Knoxville is pleased to announce that its annual Greater Knoxville Hamfest will be held again on May 24th and 25th, 1975. As always, the activities will be located in the Jacobs Building at Chilhowee Park, Knoxville. All activities, including the large flea-market, will be held indoors, so inclement weather will be no problem. In addition to the fleamarket and various exhibits, we have an excellent zoo, amusement park, and overnight camp hookups right in the Park. No hamfest admission or registration charge. Table rental for fleamarket. Ticket donations for prize drawing on Sunday. Picnic Saturday afternoon. Talk-in on 34/94 and 3980. More info from WA4BTK, John Gwin, 1316 Kirby Road, Knoxville, Tennessee 37919.

INDIANAPOLIS IN
MAY 25

The Indianapolis Red Cross Radio Club will operate a commemorative station, WI9NDY, during the hours of 1400 to 2100 GMT on May 25, 1975, the day of the 1975 500 Mile Race.

The primary operating frequencies will be 3.905, 7.275, 14.295, SSB and 146.52 FM. During the course of the operation, the following frequencies will be operated at various times depending upon band conditions and activity on the primary frequencies: 7.015 CW, 21.355, 28.505, 50.105 SSB; 52.525, 146.94 FM. A special commemorative QSL will be issued for all stations worked and submitting their QSL for verification. QSL to: Red Cross Radio Club, 441 East Tenth Street, Indianapolis, Indiana 46202.

ROCHESTER NY
MAY 31

Western New York Hamfest date is Saturday, May 31st at the Monroe County Fairgrounds. Hotel headquarters is the Rochester Marriott. FCC exams at the Hamfest. Information? Write: WNY Hamfest, Box 1388, Rochester, NY 14603.

GREEN SPEAKS

Wayne Green will be on the FM program at the Rochester Hamfest May 31 from 10:00 – 10:30 – the topic will be the effects of docket 20282 on FM and VHF operating. There are hints that Green feels that this docket will be a catastrophe for VHF and FM development.

Ivan Loucks will be running the FCC forum at 2-3:30 – Gary Hendrickson and Johnny Johnston are scheduled to be present. This should be a hot one as it comes just two weeks before the deadline for filing comments on 20282 – and the call letter restructuring docket should be flying by then, attracting fiery darts.

David M. Eisenberg WB2AGJ
7-17 Fair Lawn Avenue
Fair Lawn NJ 07410

Allband VHF Receiver: Addition

(January, 1975, pages 105-112)

Coil and Parts Information

L1, L2 – 8½ turns #26 enameled on ¼" slug-tuned form tap at 2 turns from ground end.
L3, L4 – 8 turns, same as above, no tap.
L5 – 12 turns, as above.
L6 – 6½ turns #18 enameled on 3/8" slug-tuned form, tap at 1¼ turns from cold end.
L7 – 5¾ turns #26 enameled on ¼" BRASS slug-tuned form, tap at 1¾ turns from ground.
L8 – 4¾ turns as above, tap at 1¾ turns from ground.
L9 – 3½ turns, as above, no tap.
L10 – 4½ turns, as above, no tap.
L11 – 5½ turns #26 enameled on ¼" slug-tuned form (iron).
L12 – 10 turns #26 enameled on 1/8" BRASS slug-tuned form.
L13 – Same as L6.
L14, L15, L16, L17 – 2 turns #18 airwound, ¼" diameter, ¼" long.
L18 – 7½ turns #26 on ¼" iron slug-tuned form.
L19 – 5 turns #26 enameled on 1/8" BRASS slug-tuned form.
L20 – 6½ turns, same as L6.
L21, L22, L23, L24, L29-1½" length of #14 tinned copper wire.
L21, L22 – tap at ½" from ground.
L29 – tap at ½" & 1" from ground.
L25 – 7 turns #26 enameled on ¼" iron slug-tuned form.
L26 – 6 turns #26 enameled on 1/8" BRASS slug-tuned form.
L27 – 1½ turns #26 over L26.
L28 – same as L6.
L30, L31, L32, L33 – 6½ turns #18 on 3/8 slug-tuned form, tap L30 & L31 at 1½ turns from ground.
L34, L37 – 18 turns #22 enameled on 3/8" slug-tuned form, tap 4 turns from cold end.
L35, L36, L38 – same as L34 but without tap.
L39 – Miller #1727
T1 – Miller #1725
T2 – Miller #1726
T3 – 455 kHz i-f Transformer
Varicaps – Motorola mv (1634) (25 pF @ 4 volts)
Z1, Z2 – cf-04 (clevite) (451 kHz)
Z3, Z4 – cf-04 (clevite) (459 kHz)
For diodes in Fig. 7 and 8 which have no identification other than the letter "D", use 1N4001 or 1N914 – or any low voltage, high back resistance silicon diode.

. . .WB2AGJ

OLD WESTBURY NY
JUNE 1

The Long Island Mobile Amateur Radio Club (LIMARC) will hold an all-electronic flea market and auction on Sunday, June 1 (rain date June 22) from 10 am to 6 pm at the New York Institute of Technology at Route 25A and Whitney Lane, Old Westbury, New York. Auction will begin at 4 pm. Items to be sold include communications equipment, hi-fi, TV, components, test equipment, etc. Admission is $1 for buyers and $2 for sellers. Call-in on 25/85. Refreshments will be available.

REPEATER UPDATE

ARKANSAS

*WR5AGK	Alma	146.25	146.85
D--WA5YUT	Fort Smith	146.34	146.94
*WR5ADQ	Fort Smith	146.34	146.94
†WR5AQS	Mountain Home	146.22	146.82
*WR5AQA	Russellville	146.22	146.82
*WR5AQK	Van Buren	146.25	146.85

CALIFORNIA

*WR6ABB	Hollywood Hills	222.66	224.26
*WR6ACK	Santa Monica	146.805	146.205

COLORADO

*WR0AHK	Thornton	146.31	146.91

GEORGIA

†WR4AIH	Cumming	147.75	147.15

FLORIDA

*WR4	Belle Glade	146.37	146.97
*WR4ALZ	Bradenton	146.22	146.82
*WR4ALX	Bradenton	449.30	444.30
D--WB4TVE	Daytona Beach	146.235	146.835
*WR4ALG	Daytona Beach	146.235	146.835
*WR4AKH	Daytona Beach	147.75	147.15
*WR4AKH	Daytona Beach	448.00	443.00
†WR4ALA	Fernandina Beach	146.01	146.61
D--WR4AAF	Jacksonville	52.76	52.64
*WR4AAF	Jacksonville	52.03	53.04
D--W4MKD	Miami	CLOSED	
*WR4ALK	Miami	CLOSED	
†WR4AKZ	Miami	223.34	224.94
*WB4CPT	Ormond Beach (RTTY)	147.99	147.39
D--WB4QER	Panama City	146.10	146.70
*WR4ALU	Panama City	146.10	146.70
*WR4AJZ	Pompano Beach	146.01	146.61
D--WR4	Sarasota	146.22	146.82
†WR4ALV	Starke	146.13	146.73
D--WB4QEN	Tampa Bay	147.75	147.15
*WR4ALT	Tampa Bay	147.75	147.15
†WR4ALT	Tampa Bay	146.28	146.88
†WR4ALT	Tampa Bay	147.87	147.27
†WR4AKK	Titusville	146.31	146.91

ILLINOIS

D--W9MJL/9	Danville	146.22	146.82
*WR9AEE	Danville	146.22	146.82

IOWA

†WR0AGK	Creston	146.19	146.79

MICHIGAN

D--WR8AEU	Battle Creek	146.07	146.67
*WR8AEL	Battle Creek	146.07	146.67
D--WR8ABN	Detroit	CLOSED	
D--WR8ABN	Detroit	449.50	444.50
*WR8	Detroit	146.10	146.70
*WR8AFN	Galien	52.01	53.01
*WR8AFN	Galien	448.900	443.900
†WR8AFR	Howell	147.63	147.03
*WR8AFS	Lachine	146.16	146.76
*WR8AFZ	Lansing	146.22	146.82
*WR8AFZ	Lansing	146.34	146.94
*WR8	Lapeer	146.01	146.61
*WR8AEF	Mt. Clemens	222.90	224.10

MINNESOTA

*WR8	Detroit Lakes	146.25	146.85
D--W0GUP	Duluth	146.34	146.94
*WR0AIM	Duluth	146.34	146.94

MISSISSIPPI

†WR5AID	Greenville	146.22	146.82
*WR5AQR	Lucedale	146.31	146.91
*WR5AHY	Meridian	146.16	146.76
*WR5AHJ	Tupelo Fulton	146.04	146.64

MONTANA

*WR7AFE	Helena	146.16	146.76

NEVADA

*WR7AFI	Reno	222.50	224.10

NEW HAMPSHIRE

†WR1ABU	Concord (CD)	146.34	146.94

NEW JERSEY

*WR2AEU	Lawrenceville	147.84	147.24

NEW MEXICO

D--WA5KUI	Alamogordo	146.34	146.94
*WR5AHD	Alamogordo	146.34	146.94

NEW YORK

*WR2	Albion	146.16	146.76
*WR2	Newark	146.13	146.73
D--WR2AGH	Oswego	146.16	146.76
*WR2AGH	Owego	146.16	146.76

NORTH CAROLINA

*WR4ALD	Franklin	147.84	147.24
*WR4ALC	Hendersonville	52.01	53.99
*WR4ALC	Hendersonville	146.04	146.64

NORTH DAKOTA

†WR0ADO	Fargo	146.16	146.76
*WR0AED	Grafton	146.16	146.76
*WR0AQR	Grand Forks	146.34	146.94
*WR0AFV	Petersburg	146.22	146.82

OHIO

*WR8	Cincinnati	147.63	147.03
*WR8AFO	Lancaster	147.63	147.03
*WR8	Medina	147.63	147.03
*WR8AGO	Nelsonville	147.72	147.12
*WR8	Parma	147.78	147.18
*WR8AFP	Washington C.H.	147.87	147.27

OKLAHOMA

*WR5AHX	Miami	146.22	146.82
†WR5AFW	Norman	146.28	146.88

PENNSYLVANIA

*WR3ADJ	Berwyn	147.96	147.36
*WR3AEI	Corry	146.06	146.69
*WR3ACY	State College	146.16	146.76
*WR3AEN	State College	146.25	146.85

SOUTH DAKOTA

*WR0AIR	Sioux Falls	CLOSED	

TEXAS

*WR5AHU	Kingsville	449.10	444.10

WASHINGTON

*WR7ADB	Marysville	222.34	223.94
*WR7ACG	Seattle	147.69	147.09

WISCONSIN

*WR9AFC	Platteville	146.22	146.82

CANADA

ALBERTA

†VE6VHF	Rocky Mt. House	146.28	146.88

BRITISH COLUMBIA

†VE7ELK	Chilliwack	146.46	147.00
†VE7VIC	Victoria	146.25	146.85
†VE7BEL	Victoria	146.25	146.85

MANITOBA

*VE4OI	Shilo	146.25	146.85

NEW BRUNSWICK

*VE1PL	Bathurst	146.22	146.82
*VE1CO	Moncton	146.13	146.73

NOVA SCOTIA

*VE1	Port Hawkesbury	146.28	146.88
D--VE1	Prince Edward Is.	52.525	147.00
†VE1JD	Sydney	146.34	146.94
*VE1GM	Yarmouth	146.34	146.94

ONTARIO

*VE3MHZ	Brampton	146.28	146.88
D--VE3CRA	Ottawa	146.34	146.94
D--VE3CRA	Ottawa	443.30	448.30
*VE3TIR	Ramore	146.46	147.06
†VE3SRS	Sudbury	146.16	146.76
*VE3WAW	Wawa	146.34	146.94
D--VE3III	Windsor	146.28/146.46	147.06
*VE3III	Windsor	146.46	147.06
D--VE3III	Windsor	147.66	147.06
*VE3III	Windsor	147.60	147.06
D--VE3III	Windsor	444.90	147.06
*VE3III	Windsor	449.90	147.06

PRINCE EDWARD ISLAND

*VE1AIC	Charlottetown	146.10	146.70

QUEBEC

†VE2SP	Alma	146.34	146.94
†VE2IU	Chicoutimi	146.16	146.76
*VE2CRA	Hull-Ottawa	443.30	448.30
†VE2TA	Mt. Orford-Granby	146.19	146.79
*VE2ASU	N.D. de Backland	146.70	147.60
D--VE2IU	Saguenay District	146.16	146.76
D--VE2VP	Saguenay District	146.22	146.82

SASKATCHEWAN

*VE5	Melville-Yorkton	146.22	146.82
*VE5	Prince Albert	146.46	147.06

ENGLAND

GB3LT	Luton	431.75	433.25
GB3PY	Cambridge	431.35	433.35
GB3SC	Sutton Coldfield	432.025	
GB3DD	Dunstable Downs	1296.05	

* New † Change D Delete

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NORTHWESTERN Pennsylvania Swapfest, May 3. Crawford County Fairgrounds, Meadville. Flea market begins 10 am. ($1 to display) Free admission, hourly door prizes, refreshments available. Commercial displays welcome. Indoors if rain. Talk-in 146.94, 146.04-.64 and 29.0 MHz. Map and details: RAE, Box 844, Erie PA 16512.

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FOR SALE: Heath DX60, HG-10, GD-125, HD-10, HM-102; Micro Comm V.X.O. – NUX-1; Kenwood R-599A, S-599, 6 ES 2M converters. Steve Black, Star Rte 8, Searcy, Arkansas 72143.

PUSH-BUTTON TELEPHONE to step dialing IC $10.00, TCA430 Quad tone generator $3.00, Memory plane 20k bits $12.00, Wire – 18-2 $15.00, 18-3 $21.00, 20-2 shielded jacketed 1300 ft. $29.00. All above stranded, twisted #26 solid $10.00M, #30 solid $10.00M. PC Board. Some pieces discolored. All G10. 4¼" x 24" x 3/32" one sided 2/$2.00 7½" x 16" x 3/32" $1.50. Following 1/16" two sided 6" x 18" $3.00, 8" x 18" $3.50, 9" x 18" 2/$6.00. Large SASE for list. Interested in quantities of some Mos and special chips. Nothing prepaid. Doug Craton, 5625 Balfrey Drive, West Palm Beach FL 33406.

STANDARD SR-C146MA 2 watt Handy Talkie, 5 channel capacity, supplied with two channels, $240.00; sr-c826MA 10 watt mobile, 12 channel capacity, supplied with four channels, $335.00. Accessories available. Write for catalog and prices. BERCOM ELECTRONICS, P.O. Box 237, Bergenfield NJ 07621. Also TTL devices, 18 popular types available, with spec. sheets.

WANTED: Back copies electronics and ham magazines. Will swap with 1950's CQ, QST, others, or buy. Need old copies ARRL Handbook, Callbook, other amateur radio books and publications. State price or request Trading List. Also want Friden Flexowriter, any condition. Donald Erickson, 6059 Essex, Riverside, CA 92504. (714) 687-5910.

THE 3RD ANNUAL Des Moines Hawkeye Hamfest will be held on Sunday, June 8, 1975 at the Iowa

CATALOG
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WANTED: Parts for a MITE Corp. Teletypewriter, model TT-299B/UG. Please send list to: Dennis Steele, 630 Braddock Avenue, La Vale, MD 21502.

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NEVER SAY DIE from page 3

mailed out on Thursday and arrives Saturday morning, or at the latest by Monday.

Some amateurs are putting the Hotline info on tape and running it through the local repeater nightly on schedule to bring everyone up to date – some are playing it on the low bands on net sked – this is material of interest to amateurs and thus qualifies for general news broadcast under FCC regs.

WARNING

The Whipple telephone articles are designed to help repeater autopatch circuit developers understand the phone system so they will not inadvertently get into troubles with the phone company switching systems. Readers of 73 know that autopatches and repeaters often rely upon very sophisticated tone control systems (see the 73 book, *Digital Control of Repeaters*), so there is a real danger of the amateur system and the telephone company system not being compatible unless the amateur understands what is happening on the phone lines.

A word of warning should be enough, even to overly enthusiastic teenagers: the circuits for gadgets which have been used for defeating phone tolls are presented for historical purposes and to help designers of amateur control gear. Bell has worked out ways to contend with these things and users are quickly caught. Hotline readers will remember the recent conviction of a well known antenna expert (for another ham magazine) who got out of his field and tried to match wits with Ma Bell.

Autopatch and control circuits will continue to be developed by experimenting amateurs as long as they don't create problems, so the publication of these circuits is important for amateur radio. Don't mess around... Bell has absolutely no sense of humor about these things whatever. One ham lost his job with the phone company when he made up an autopatch unit in a blue colored box, and it took him thousands of dollars in legal fees to get his job back. The mere blue color seemed to do it to Bell, who was suffering from an attack of so-called Blue Box units which were running all through the long distance circuits without any billing. D-o-n-'-t m-e-s-s.

... W2NSD/1

STOLEN: GTX-2, serial #2958, 10 crystals. Contact Michael McNeely K9HCK, 618 Sheridan Road, Evansville IN 47710 or Evansville Police Department.

FILCHED: HT200, serial #U24407, lost from Grand Rapids MI Airport. Contact Ray Thomas WA8WEJ/6.

PILFERED: 2 meter FM rig, serial #2402350. Contact Jimmy Jones W8OYL.

PURLOINED: Regency HR-212, serial #2400829, at the Massillon Ham Auction. Contact Bob K8COT.

BURGLED: SB 144 fully crystaled, serial #460118 in Wilmington, Delaware. Contact Ralph L. Hairsine K3MPZ, 1408 Wedgewood Road, Wilmington, Delaware 19805.

LIFTED: ICOM IC-230, serial #2266. Contact Tony Gargano W2EHB, 32 Bryant Road, Blackwood NJ 08012.

RIPPED OFF: IC-230, serial #1062, acoustic pad, shure noise cancelling mike. Contact Fred K4CLJ.

PIRATED: Clegg, FM 27-B, serial #27093-2683. Contact Blain W4BNS.

LOOTED: ICOM IC-22, serial #8768 with microphone. Contact Amarillo TX Detective Bureau or WB5BKL, 1136 Cinderella, Pampa, TX 79065.

ROBBED: Motorola Mocom 70 Base Station, L53BBB-3100AM, serial #KA2090. Contact Richard M. Hambly WB2TNL, 16 Gaslight Drive, 1, South Weymouth MA 02190 by mail or telephone collect (617) 335-8574.

SHANGHAIED: Standard Handie Talkie Model 146A, serial #310377 along with Standard Mini-Mike. Contact Hy Chantz WB2HYW.

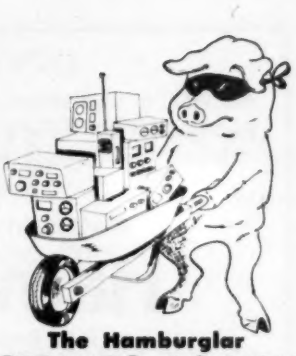
MISAPPROPRIATED: Regency HR2B, serial #49-01726. Contact W2EKB.

KIDNAPPED: Standard SR-C 826M, serial #11082 with xtals for 9 positions. Contact John Gubernard K2LSX, 252 Park Avenue, Cliffside Park NJ 07010.

MADE OFF WITH: TR-22, 12 channels, channel 6 wired together plus GLB homemade synthesizer. Contact Terry Fox WB4JFI.

ABDUCTED: 2 meter transceiver, serial #620615. Contact Loal J. Broulette FTGC, FT "C" School Staff, Great Lakes IL 60088.

SWIPED: Yaesu FT401 A, serial #316104, Yaesu FV401, serial #679927, Collins 75A4, serial #5564, Johnson Valient 2916. Contact K2UPD.



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PILLAGED: FT101 with 160 meters, serial #82L129340/CWF. $100 reward offered for return or positive information leading to its recovery. Contact Paul Skitzki W1FX, P.O. Box 187, Portsmouth RI 02871. (401) 683-0326.

RIFLED: FM27B with D.A.R.T., serial #27403-1624. Contact Gary Black, 3872 Royal, Berkley MI 48072, (313) 546-8859, or Det. Sgt. Flynn, Berkley Police (313) 541-9000.

HIJACKED: FR-2514 Sonar scanner, one Sonar FR-2515 scanner, G.E. single freq control head and one Motorola Control Head (MOTRAC), Motorola PTT mike and one Shure PTT mike. Contact Los Angeles County Sheriff (Lakewood Station), 5130 Clark Avenue, Lakewood CA 90712. Burglary report file No. 03421. Sheriff (213) 866-9061. K. Higgins WB6HSK (213) 425-1174.

RUSTLED: Motorola HT-220, serial #L24J6W and Motorola HT-220, serial #M74J74. Contact Mr. E. S. Janecek, Union Carbide Corporation, P.O. Box 3370, Brownsville TX 78520.

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73 Magazine — Peterborough NH — 03458

BE MY GUEST from page 5

station within the rules, is courteous to others, doing his "part" for amateur radio, then what can this accomplish other than one large mess of paperwork? If you are going to re-examine amateurs on a large scale, then re-examine all amateurs regardless of license class. Is the amateur who was licensed 35 years ago as technically competent as the 15 year old high school kid who got his Tech ticket last week? Is longevity the one and only prerequisite to technical competence? *Why waste time penalizing those who are acting in the best interest of amateur radio when this time could better be spent in silencing those incompetents that willfully and maliciously jam our repeaters and HF public service nets?* Did I say time? I should have said time and money. Re-examination for violation of the rules I favor since it is the one way of ridding amateur radio of detrimental elements that could harm it in the long run.

If it is true incentive toward up-grading that 20282 is aimed at, than rather than re-examine for the same class, put a maximum license term on all license classes and let this be an up-grading program rather than a penalization program. I suspect that under the present scheme, the number of good operators we would lose might well surpass the number of bad ones we would retain. What kind of an incentive is it for someone who has been a Tech or Conditional for many years, obeyed the rules without question, been the kind of operator that we have been proud to call a fellow ham, to find that he must cram his fool head off for no reward other than the partial continuance to what he or she already has — and then to have to look at the free access to the Communicator license, and what is being handed to them on a silver platter.

One thing that the commission failed to consider is that a Conditionally licensed amateur who entered amateur radio 20 years ago may have one heck of a hard time starting to "learn it all again." Many might elect to down-grade to Communicator rather than hassle the whole thing. On VHF especially, you could conceivably quickly wind up with millions of Communicators dependent upon a handful of Experimenters to provide the "mountain top" hardware and this could easily lead to dictatorship on the part of a select few over the masses. Unless I miss my guess, this is a bit contrary to what America is all about. Not that this would happen, hopefully not, but under 20282's present structure it could.

While the following may be a minor point, after you think about it, it makes a lot of sense. At the last SCRA meeting, an interesting point about semantics was raised by someone who is truly the father of modern repeater communication, and a person I have a great deal of admiration for: Art Gentry W6MEP, owner of WR6ABN, perhaps the oldest continual operation repeater in the country. To paraphrase Art, a person is an "Experimenter" until the time he reaches a level of technical competence to be called a "Technician." I agree with Art since in daily life one is an experimenter until such time as he or she attains the necessary knowledge to function as a technically competent professional in whatever profession that one might choose. Maybe the two license class names should be interchanged to follow this particular line of thought; I think so.

This brings us to another penalty that will be imposed upon the General and Technician of today. While I can go with the reduced power limitations to be imposed upon different license classes, please tell me how such a program can be administered without periodic inspection of each and every amateur station in the country? I realize that today's modern electronics entails some highly sophisticated equipment, but I have yet to hear of any piece of equipment that can listen to an incoming signal and read out the power level that the transmitter is operating at. Are we beating dead horses again?

I still find it a bit hard to believe that after developing some of the most sophisticated communication and control systems around today, the Technician will be rewarded for his years of effort by being prohibited from using tone-burst, touchtone and sub-audible tone squelch in a like manner to the General losing his Slow-Scan TV and RTTY. Is this incentive to expand one's knowledge or punishment for years of meritorious service? How many repeaters that are owned by or licensed to Technicians will just "go away" because the said licensee will feel he has better things to do with his time than to start from scratch and pound "book and key" just to retain what he already has? The damage may well be irreparable.

To me amateur radio is a hobby, one that I love but far from the only thing in my life. My job and family obligations are far more important and I suspect that the same holds true for many of you. With many of us working more than one job in order to make ends meet (I personally function as a consultant to a University Research Program and as Tech-Rep for a Bio-Med Electronics Company in addition to my regular 8 hour a day job as Television Service Technician for one of the largest merchandisers in the country) in this time of prolonged economic crisis, where do you find the time to start over again?

Amateur radio is my hobby, my escape from the ills of the day, not another job on top of what I already have to do. There are but 24 hours in a day. Perhaps I am crazy, but I enjoy amateur radio. It fulfills a need in my life and I am grateful for its existence. My "thing" is writing about it, all aspects of it since about 1961, with a short break in this routine between '63 to late '71, though not by choice. I went under the byline "staff" in most of those cases. There are those that build repeaters, bounce signals off the moon, travel to the farthest corners of the world on DXpeditions, put up satellites like the Oscars, and just sit home and chew the fat. Each has his little bit to give that builds amateur radio. Each of us has his or her place in it.

If it's numbers that we need to secure the longevity of amateur radio, then a Communicator Class license is one route, but it should be subject to the same if not more stringent regulation that all other license classes are subject to. If you are going to re-examine any single class of "Conditionally Licensed" amateur, then the Communicator MUST be included in this. Why should today's currently licensed amateurs be penalized when at the same time the un-trained are being handed free, what we now have? If you are going to create a Communicator Class of license, then it too must be subject to the same incentives to up-grade that are to be put upon all other license classes even if this means up-grade or out after the initial license term. Yes, we need a Communicator Class license because we need numbers to survive, but how far must we sacrifice quality in order to obtain quantity? I want a Communicator Class license but only if it is treated with the same objectivity as all other license classes, and only if!

...WA6ITF

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DL44	Red	6.00
DL402	Red	4.00
DL701	Red	3.40
DL704	Red	2.25
DL707	Red	2.35
DL747	Red	2.50

XCITON

XAN72 Red	2.00
XAN02 Green	2.00

EP 9125
9-DIGIT DISPLAY
$7.90

- 1/8" character height
- compact, thin PC package
- wide viewing angle

LEDs

.125" dia.

209 Red	$.25
209 Yellow	.35
209 Green	.35

.160" dia.

216 Red	.25
216 Yellow	.30
216 Green	.30

.200" dia.

220 Red	.25
220 Yellow	.30
220 Green	.30

LOW PROFILE

226 Red	$.25
226 Yellow	.30
226 Green	.30

5053 Red	.35
5053 Yellow	.40
5053 Green	.40
5053 Orange	.40

216 = MV5024
5053 = MV5053

MV50 Red $.30

7400N TTL

7400N	.16	7444N	1.05	7486N	.85	74161N	1.20
7401N	.23	7445N	1.04	74100N	1.45	74162N	1.50
7402N	.22	7446N	1.10	74104N	1.25	74163N	1.48
7403N	.22	7447N	1.10	74105N	.45	74164N	1.78
7404N	.21	7448N	1.10	74107N	.45	74165N	1.78
7405N	.21	7450N	.17	74108N	.92	74166N	1.54
7406N	.36	7451N	.83	74110N	.72	74170N	2.60
7407N	.46	7453N	.23	74111N	.92	74173N	1.85
7408N	.23	7454N	.26	74114N	.92	74174N	1.40
7409N	.23	7455N	.37	74115N	.92	74175N	1.80
7410N	.18	7460N	.26	74118N	1.51	74176N	1.54
7411N	.27	7462N	.37	74119N	1.60	74177N	1.54
7412N	.52	7464N	.37	74121N	.54	74180N	1.05
7413N	.72	7465N	.37	74122N	.51	74181N	3.49
7414N	2.25	7470N	.39	74123N	.92	74182N	.78
7415N	.37	7471N	.49	74125N	.64	74184N	2.86
7416N	.37	7472N	.33	74126N	.64	74185N	2.29
7417N	.37	7473N	.41	74128N	1.32	74188N	4.90
7420N	.18	7474N	.40	74132N	2.06	74190N	1.49
7421N	.60	7475N	.70	74136N	.92	74191N	1.49
7422N	.27	7476N	.46	74140N	1.50	74192N	1.45
7423N	.48	7478N	.55	74141N	1.19	74193N	1.29
7425N	.38	7480N	.60	74145N	1.12	74194N	1.35
7426N	.27	7481N	1.19	74147N	2.95	74195N	.89
7427N	.31	7482N	.98	74148N	2.49	74196N	2.38
7428N	.52	7483N	.98	74150N	.99	74197N	.88
7430N	.20	7484N	3.02	74151N	.84	74198N	2.09
7432N	.27	7485N	2.50	74152N	5.25	74199N	2.09
7433N	.62	7486N	.41	74153N	1.05	74200N	4.95
7437N	.41	7489N	2.50	74154N	1.62	74221N	1.75
7438N	.35	7490N	.70	74156N	1.08	74251N	1.75
7439N	1.05	7491N	1.15	74157N	1.18	74278N	2.95
7440N	.17	7492N	.84	74158N	1.18	74279N	1.10
7441N	.95	7493N	.71	74159N	1.44	74293N	.95
7442N	.95	7494N	1.29	74160N	1.50	74298N	2.56
7443N	.95	7495N	.85				

74LS

74LS00	.58	74LS76	.92	9300PC	1.00
74LS01	.58	74LS78	.92	9301PC	1.20
74LS02	.58	74LS107	.92	9304PC	1.60
74LS03	.58	74LS109	.92	9306PC	6.90
74LS04	.63	74LS112	.92	9308PC	1.50
74LS06	.63	74LS113	.92	9309PC	1.60
74LS08	.58	74LS114	.92	9310PC	1.50
74LS09	.58	74LS138	2.38	9311PC	2.30
74LS10	.58	74LS139	2.38	9312PC	2.30
74LS11	.58	74LS151	2.10	9314PC	1.30
74LS13	.58	74LS153	2.38	9316PC	1.60
74LS15	.58	74LS157	2.10	9318PC	2.60
74LS20	.58	74LS158	2.40	9321PC	1.20
74LS21	.58	74LS160	2.70	9322PC	1.30
74LS22	.58	74LS161	2.70	9324PC	2.00
74LS27	.64	74LS170	5.92	9328PC	2.60
74LS30	.58	74LS174	2.92	9334PC	2.95
74LS32	.64	74LS175	2.90	9338PC	3.30
74LS51	.58	74LS181	3.72	9340PC	5.00
74LS54	.58	74LS251	2.95	9341PC	4.10
74LS55	.58	74LS253	3.05	9342PC	1.15
74LS73	.92	74LS260	.58	9360PC	1.75
74LS74	.92			9366PC	1.75

9300 SERIES

CALCULATORS (Limited Qty.) $19.00

1024-BIT N-Channel RAM

2601-1	11.40
2601-21	11.40
2602B	8.00
2602-1B	8.00
2602-2B	8.00
MK4102P	11.40
7582-1CPE	8.00
7582-2CPE	8.00

OPTOISOLATORS

MONSANTO

MCT2 1.35

LITRONIX

IL1	1.30
IL12	1.80
IL16	1.80
IL74	1.35
ILD74	1.75
ILQ74	3.40

1-AMP RECTIFIERS

	10	100	1000
1N4001	1.00	7.00	60.00
1N4002	1.10	8.00	70.00
1N4003	1.20	9.00	80.00
1N4004	1.30	10.00	90.00
1N4005	1.40	11.00	100.00
1N4006	1.50	12.00	110.00
1N4007	1.60	13.00	120.00

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CY1021A	Instr. Amp., FET Input	59.00
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CY2218	DAC, 12 Bit, 2 Quad Multiplying	149.00
CY2237	DAC, 12 Bit, Low Drift	69.00
CY2735	DAC, 4 Digit BCD, Low Cost	79.00
CY3035	ADC, 8 Bit, Sect. Counting, Low Cost	89.00
CY3635	ADC, 3 Digit BCD, Sect. Count, Low Cost	119.00

SCHOTTKY TTL

74S00N	.45	74S74N	1.30	74S158N	2.40
74S02N	.80	74S85N	6.10	74S160N	4.70
74S03N	.75	74S86N	2.70	74S161N	4.70
74S04N	.75	74S112N	2.20	74S174N	3.30
74S08N	.80	74S113N	1.50	74S175N	3.30
74S10N	.75	74S132N	3.60	74S189N	5.10
74S11N	.95	74S133N	.90	74S194N	3.30
74S20N	.60	74S138N	2.40	74S196N	3.30
74S30N	.80	74S139N	2.40	74S251N	2.40
74S32N	.80	74S140N	.90	74S253N	2.40
74S40N	.80	74S151N	2.40	74S257N	2.40
74S51N	.80	74S153N	2.40	74S258N	2.40
74S64N	.80	74S157N	2.40	74S280N	5.70

LOW POWER TTL

74L00N	.34	74H00N	.34	74H53N	.36
74L02N	.34	74H01N	.34	74H54N	.36
74L03N	.39	74H04N	.36	74H55N	.36
74L04N	.39	74H05N	.37	74H60N	.36
74L10N	.34	74H08N	.40	74H61N	.36
74L20N	.39	74H10N	.36	74H62N	.36
74L42N	1.62	74H11N	.36	74H71N	.80
74L51N	.34	74H20N	.36	74H72N	.74
74L73N	.74	74H21N	.36	74H73N	.90
74L74N	.89	74H22N	.36	74H74N	.87
74L90N	1.62	74H30N	.36	74H76N	.90
74L93N	1.62	74H40N	.36	74H101N	1.00
74L95N	1.62	74H50N	.36	74H102N	.80
		74H51N	.36	74H103N	1.10
93L00	1.50	74H52N	.36	74H106N	.95
93L01	1.60				
93L08	3.20				
93L09	1.80				
93L10	2.80				
93L11	4.20				
93L12	1.80				
93L14	1.70				
93L16	3.20				
93L18	3.50				
93L21	1.80				
93L22	1.80				
93L24	2.80				
93L28	3.70				
93L34	4.00				
93L38	4.20				
93L40	6.50				
93L41	6.90				
93L60	2.70				

HIGH SPEED TTL

AUDIO AMPS

Type	V	W	Ω	Price
LM383	6-15	1.15	8	1.60
LM384A	6-27	2.60	8	2.90
TAA611B12	6-15	1.15	8	1.60
TAA621A12	6-27	1.40	8	2.00
TAA641B11	6-18	2.20	4	3.00
TBA800	6-30	4.70	8	2.20
TBA810AS	4-20	2.50	4	3.00
TBA820	3-16	0.75	4	1.70
TCA830	6-20	2.00	4	2.20
TCA940	6-24	6.50	8	4.40

IC SOCKETS

SOLDER - TIN

8 pin DIL	.22
14 pin DIL	.26
16 pin DIL	.29
24 pin DIL	.75
28 pin DIL	1.10
36 pin DIL	1.70
40 pin DIL	1.90

WIRE WRAP-GOLD

14 pin DIL	.40
16 pin DIL	.45

SOLDER - GOLD

14 pin DIL	.35
16 pin DIL	.40

TCFLOW

3 pin TO-5	.55
4 pin TO-5	.65
8 pin TO-5	.90
8 pin TO-5 Y	1.10
10 pin TO-5	1.40

LINEAR ICs

H-TO5 N-DIP M-MINI-DIP D-CER-DIP K-TO3

		LM114N	3.00	LM311H	1.70
		LM300H	1.20	LM311D	1.90
		LM301AH	1.00	LM311N	1.75
		LM301AN	.90	LM311N	2.00
		LM301AM	.80	LM312H	2.70
		LM301AH	1.10	LM318H	2.60
		LM301M	.90	LM324N	1.90
		LM301H	.90	LM331N	2.20
		LM302H	3.95	LM320-5K	2.90
		LM302N	1.30	LM320-5K	2.90
		LM302H	1.50	LM320-5T	2.50
		LM308H	1.00	LM320-12K	2.90
		LM308N	1.05	LM320-12T	2.50
		LM308AH	1.05	LM340-05K	2.60
		LM308N	1.00	LM340-12K	2.60
		LM308AH	.95	LM340-18K	2.60
		LM307N	1.50	LM340-18K	2.60
		LM308H	1.20	LM340-24K	2.60
		LM308AH	1.00	LM555CM	1.00
		LM308D	2.00	LM556CN	1.30
		LM308M	1.20	LM709CH	.45
		LM308H	1.15	LM709CN	.45
		LM309K	1.95	LM710CH	.90
		LM310H	1.60	LM710CN	.90
		LM316M	1.60	LM711CH	.90
75107				LM711CN	.90
75107BN	2.60	LM301AH	.90	LM715CH	4.30
75108BN	2.30	LM301AM	.80	LM715CD	4.60
75109N	2.20	LM301AH	1.10	LM723CH	.90
75110N	2.20	LM301M	.90	LM723CN	.75
75115N	2.25	LM301H	.90	LM725CH	5.00
75138N	3.95	LM302H	3.95	LM725CD	5.20
75150N	3.10	LM302N	1.30	LM733CH	1.40
75154N	4.10	LM302H	1.50	LM733CN	1.25
75208N	1.00	LM308H	1.00	LM741CH	.44
75234N	2.50	LM308N	1.05	LM741CN	.44
75450N	1.25	LM308AH	1.05	LM741CH	.70
75451N	1.00	LM308N	1.00	LM741CN	.70
75452N	1.00	LM308AH	.95	LM747CH	1.70
75453N	1.00	LM307H	.95	LM747CN	.90
7520 SERIES		LM307N	1.50	LM748CH	.55
SENSE AMPS		LM308AH	1.00	LM748CN	.55
7520N	4.00	LM308D	2.00	LM777CH	2.15
7521N	2.00	LM308M	1.20	LM777CN	2.15
7522N	4.25	LM308H	1.15	LM3046CH	.95
7523N	1.75	LM309K	1.95	LM3046CN	1.50
7524N	2.00	LM310H	1.60	SG4501T	2.20
7525N	4.50	LM316M	1.60	SG4501N	2.20
				LM5000K	7.50

LOW POWER REGULATORS

LM335K:	5V, 600mA 2.40
LM336K:	12V, 600mA 2.90
LM337K:	15V, 480mA 2.90

BIPOLAR MEMORY

C3101	6.50
P3101	4.90
C3101A	7.30
P3101A	5.80
1M5501CDE	7.30
1M5501CPE	5.80
MM5550D	7.30
MM5550N	5.80
DM8223N	5.80
93403PC	5.80

MOS-LSI

P1101A	6.90	C2102-2	8.00
P1101A1	9.50	P2102-2	6.00
1402AN	5.40	2505K	4.30
1403AH	8.00	2512K	5.50
1403AN	5.40	2521V	4.00
1404AH	8.00	2524V	3.90
1404AN	5.40	2525V	5.30
1405A	4.10	2533V	8.50
1506	4.00	3341PC	8.20
1507	4.00	MM5025N	20.00
1602	33.00	MM5026N	20.00
1702	33.00	MM5027N	20.00
C2102	8.00	MM5055N	5.50
P2102	6.00	MM5056N	5.50
C2102-1	8.00	MM5057N	5.50
P2102-1	6.00	MM5058N	5.50

MM

MM404H	12.00
MM405H	23.00
MM405[1]	6.50
MM407H	6.50
MM451H	11.40
MM454F	18.00
MM506H	3.20
MM507H	3.20
MM550H	5.90
MM551H	5.60
MM555H	5.60

HYBRID Power AMPLIFIERS

SI-1010G 10W $6.90
SI-1020G 20W 9.90
SI-1030G 30W 18.70
SI-1060G 50W 25.90

POWER TRANSISTORS

SU204	3A	1300V	$4.14
BU205	3A	1500V	4.95
BU206	3A	1700V	5.94
BU207	6A	1300V	5.85
BU208	6A	1500V	6.93
BU209	6A	1700V	8.64

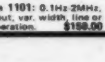
TRANSISTORS

2N173	2.15	2N3446	5.00	2N3967	1.60
2N5129	2.90	2N3643	.19	2N3971	1.95
2N677C	5.50	2N3645	.19	2N4045	1.95
2N697	.25	2N3647	.19	2N4228	.50
2N711	.50	2N3648	.17	2N4249	.18
2N918	.40	2N3642	.19	2N4303	.30
2N1136	1.50	2N3643	.14	2N4341	1.35
2N1377	1.50	2N3644	.19	2N4347	1.50
2N1483	1.20	2N3657	9.00	2N4348	2.00
2N1834	1.00	2N3684	1.25	2N4396	1.30
2N1893	.50	2N3702	.18	2N4416	.90
2N1844	.90	2N3707	.17	2N4858	1.10
2N1924	1.30	2N3711	.18	2N4859	1.20
2N1924	1.90	2N3724	.40	2N4861	1.00
2N2102	.60	2N3731	2.00	2N5038	1.18
2N2219	.30	2N3771	2.20	2N5127	.16
2N2221	.25	2N3772	2.40	2N5190	4.30
2N2484	.25	2N3773	3.40	2N5306	.27
2N2713	.18	2N3789	3.00	2N5400	32.00
2N2906	.18	2N3810	.20	2N5463	5.40
2N2907	.20	2N3823	.70	2N5457	.40
2N2925	.15	2N3866	1.10	2N5458	.40
2N3053	.35	2N3904	.20	2N5770	.55
2N3055	.95	2N3906	.25	2N6027	.50
2N3202	16.00	2N3908	.80	2N6028	.85
2N3227	1.80	2N3955	2.70	2N6099	.55
2N3375	5.50	2N3955A	3.20	2N6101	.85
2N3442	2.20			2N6103	.90

SPECIFICATION SHEETS: $.25 ea.

COMPUTER INTERFACE

DM8820N	2.40
DM8820AN	6.90
DM8830N	2.40
DM8831N	5.20
DM8832N	6.00
N8T26B	4.40
9600PC	1.30
9601PC	1.20
9602PC	2.10
9614PC	2.30
9615PC	2.40
9660PC	6.00
9617PC	3.50
9620PC	4.00
9621PC	4.00



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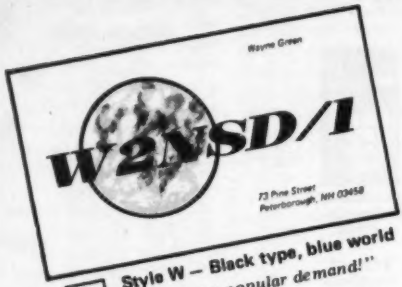

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- two colors
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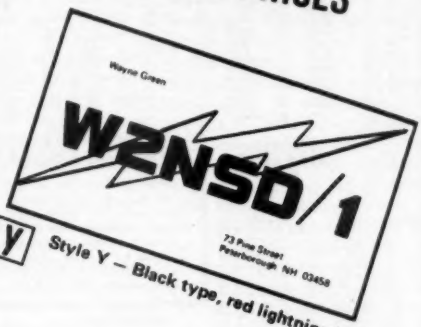
X Style X – Black type, blue satellite



Y Style Y – Black type, red lightning bolt

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X ☐
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Amount enclosed $_____

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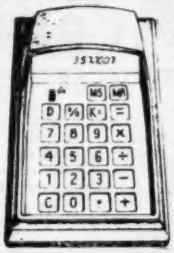
8 DIGIT FLOATING POINT CALCULATOR KIT Now you can afford to trade up to a more powerful calculator. Not to be confused with the regular four-banger, this calculator has 5 functions (+ - x ÷ %), and features memory plus a separate constant register for problems involving simultaneous memory and constant. Timed display turnoff (really saves batteries), negative sign tracks most significant digit. This easy to assemble kit comes complete with detailed instructions, all parts, handsome gray case, AC adapter jack, hardware and wire, but less batteries. You might be surprised at how much computational power you can get for only $17.95, and that's postpaid.



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7453	.20	74176	1.60
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P2	T0-92	PNP	lo-level	.15	.10
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7403	.25	7460	.16
7404	.25	74L71	.25
74H04	.30	7472	.40
7405	.30	74L72	.60
7406	.40	7473	.35
7408	.30	74L73	.75
74H08	.30	7474	.45
7410	.20	74H74	.75
7413	.75	7475	.80
7417	.40	7476	.55
7420	.20	74L78	.70
74L20	.30	7480	.50
74H20	.30	7483	.70
74H22	.30	7489	3.00
7430	.20	7490	1.00
74H30	.30	7492	.65
74L30	.30	7493	1.00
7440	.20	7495	.65
74H40	.30	74L95	1.00
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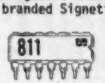

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7409	.25	7496	.89
7410	.19	74105	.49
7411	.29	74107	.49
7413	.79	74121	.57
7415	.39	74122	.53
7416	.39	74123	.99
7417	.39	74125	.69
7420	.19	74126	.79
7422	.29	74141	1.23
7423	.35	74145	1.15
7425	.39	74150	1.09
7426	.29	74151	.89
7427	.35	74153	1.29
7430	.22	74154	1.59
7432	.29	74155	1.19
7437	.45	74156	1.29
7438	.39	74157	1.29
7440	.19	74161	1.39
7441	1.09	74163	1.59
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7445	1.10	74173	1.65
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7447	1.15	74176	1.65
7448	1.15	74177	.99
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7460	.19	74190	1.59
7464	.39	74192	1.49
7465	.39	74193	1.39
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710	Hi speed V comp	DIP	.39
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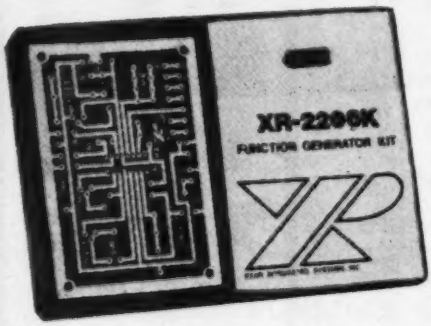

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7406	.50	7494	.97	
7407	.50	7495	.95	
7408	.25	7496	.95	
7409	.25	74100	1.50	
7410*	6/1.00	74107	.47	
7411	.30	74121	.55	
7412	.40	74122	.47	
7413*	.75	74123	1.05	
7416	.45	74125	.60	
7417	.45	74126	.80	
7418	.25	74141	1.15	
7420	.23	74145	1.15	
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7423	.32	75151	1.20	
7425	.27	74153	1.50	
7426	.31	74154	1.25	
7427	.32	74155	1.30	
7429	.40	74156	1.30	
7430	.33	74157	1.55	
7432	.26	74160	1.65	
7437	.45	74161	1.65	
7438	.50	74163	2.50	
7439	.50	74164	2.50	
7440	.23	74165	2.50	
7441	1.10	74166	1.75	
7442	1.05	74170	3.00	
7443	1.10	74173	1.75	
7444	1.15	74174	1.85	
7445	1.10	74175	1.85	
7446	1.25	74176	.85	
7447*	.89	74177	.85	
7448	1.25	74180*	1.00	
7450	.25	74181	3.75	
7451	.27	74182	1.00	
7453	.27	74184	2.30	
7454	.40	74185	2.30	
7459	.25	74187	7.00	
7460	.25	74190	1.50	
7470	.45	74191	1.50	
7472	.41	74192*	1.25	
7473*	.39	74193*	1.25	
7474	.47	74194	1.50	
7475*	.75	74195	1.05	
7476*	.40	74196	1.25	
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LM340K	1.89	CA3059	2.46
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NE560	2.50	LM3905	.55*
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NE566	2.00*	LM9602	.75
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MAN-4	1.95
MAN-7	1.50
DL 33	1.95
DL747	2.50

8000 Series

8090-98	.55
8123	1.50
8223 *	3.00
8263	7.00
8267	4.00
8280	.75
8281	.85
8288	1.15
8880	1.35

Desk top calculator by well known mfgr. These are rejects, 8 digit, 4 function, liquid crystal display. Fully assembled, some factory reject, some customer returns. Most are repaired in a few minutes. Sold "as is." Ship wt 3 lbs.
AC model $10 each 3 for **$26.50**
Battery portable model $11 each 3 for **$30.00**

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Solid state SQ 4 channel adapter, 2 amps built in. Decodes 4 channel or synthesizes 4 channel.
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DUAL 16 BIT MEMORY

Dual 16 bit memory, serial MOS by Philco TO-5 case, brand new with 2 page specs.
#PLR 532 $1.00 each $10/12

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For console installation, w/face plate, no knobs. Stereo amplifiers for tape or turnable playback. **$15.00**
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A hot item today. We furnish full data booklet with each order. $10 each 3 for **$25.00**

8 CHAN MULTIPLEX SWITCH

Solid state 16 pin IC MOS. 8 channel w/output enable control & one-of-eight decoder in chip. With data. Fairchild 3705. . .**$5.00**

RC OSCILLATORS

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$9.00, 3 for $25.00

Beautiful AM-FM Stereo Multiplex radios made to sell in the over $100 range. Picture shows typical unit. Solid state. AC powered, made for famous US manufacturer. Ship wt 10 lbs. **$35.00**

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It's the easiest multi-function kit today!

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- 4-Function Arithmetic
- 22 KEYS!

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EASY TO PUT TOGETHER! You bet it is . . . imagine no resistors, capacitors, but it **ONLY REQUIRES 2 CHIPS and a READOUT!** How's that for simplicity? The 2 Memory keys are MS Memory Storage and MR Memory Recall (requires very little soldering). The display restore key is to conserve battery life. Your display on panel shuts off 25 seconds after the last operation. By depressing "D" key, the display is restored! Uses 6 N' cell batteries. Red decimal appears on left to show when batteries need replacement or charging. Has Decimal, Clear, Constant, Percent, and arithmetic key red, white and blue colors. Lightweight, pocket size 5¼ x 3 x (2" at back side) x 1⅛" front side of angular display panel black case. Nifty unit for business, school, home, and for the youngsters. Slips into any pocket, briefcase with ease. Easy-to-understand pictorial instruction booklet and how-to-use-book.

AC/DC too!

KIT INCLUDES: case, 22-key keyboard kit, ON-OFF switch (part of keyboard) PC board, driver and memory array cable, AC adapter jack & wires, battery case, 6 step construction booklet, instruction and pictoral step-by-step construction booklet.

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3½ digit, 7-segment — only 1 1/16 x 11/16 x 1/4". Includes readout, socket, "slide-in-place chrome slide face plate". Same display as found in $200. units.

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☐	1N4002	100	10 for 55c
☐	1N4003	200	10 for 65c
☐	1N4004	400	10 for 75c
☐	1N4005	600	10 for 85c
☐	1N4006	800	10 for 95c
☐	1N4007	1000	10 for 1.29

	Sanken	Watts	Sale
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OR
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2 for $1
Sale good till July 15, 1975

NATIONAL LM-340T VR's

- TO-220 Case
- 1 Amp
- POSITIVE VOLTAGE

1.75 Each

Buy 3 — Take 10%

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☐	LM-340-08T	8 v
☐	LM-340-12T	12 v
☐	LM-340-15T	15 v
☐	LM-340-18T	18 v
☐	LM-340-24T	24 v

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Kit includes 4 x 2½" G-10 glass etched pc board, with 10 OAK "smooth touch" white keys with black numerals, plus diagram on "touch tone encoder". Makes many "keyboard systems" readily available. *0-to-9*

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*35 LED matrix

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☐	MAN-2	.32*	4.95	3 for $14.
☐	MAN-3	.12	1.00	3 for $2.50

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7-segment
☐ Red
☐ Yellow
☐ Green

Litronix 704
☐ Red $2.50
Litronix 707
☐ Red $2.50

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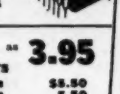

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☐	SN7403	.22
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☐	SN7405	.24
☐	SN7406	.79
☐	SN7407	.27
☐	SN7408	.27
☐	SN7409	.27
☐	SN7410	.19
☐	SN7411	.31
☐	SN7413	.99
☐	SN7414	2.25
☐	SN7415	.45
☐	SN7416	.45
☐	SN7417	.50
☐	SN7420	.23
☐	SN7422	.29
☐	SN7423	.32
☐	SN7425	.35
☐	SN7426	.31
☐	SN7427	.31
☐	SN7430	.24
☐	SN7432	.28
☐	SN7437	.45
☐	SN7438	.49
☐	SN7440	.19
☐	SN7441	1.00
☐	SN7442	1.00
☐	SN7443	1.00
☐	SN7444	1.00
☐	SN7445	1.00
☐	SN7446	1.10
☐	SN7447	1.10
☐	SN7448	1.45
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☐	SN7451	.28
☐	SN7453	.28
☐	SN7454	.28
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☐	SN74155	1.09
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800	☐ 1.59	☐ 1.95	Code: 2 amp
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25	26	27	28	29	30	31

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	7A	7	7	7	14	14	14	14A	14A	14
AUSTRALIA	14	14	7B	7B	7	7	7	7	7	7	7A	14
CANAL ZONE	14	14	7	7	7	7	7A	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7A	14	14	14	14	14
HAWAII	14	14	7B	7	7	7	7	7	7A	14	14	14
INDIA	7	7	7	7B	7B	7B	7A	14	14	14	7A	7
JAPAN	14	7	7	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
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PUERTO RICO	14	7A	7	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7A	14	14	14	14A	14	7A
U. S. S. R.	7	7	7	7	7	7	7A	14	14	14	14	7
WEST COAST	14	14	7A	7	7	7	7	7A	14	14	14	14

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ARGENTINA	14	14	14	7	7	7	7A	14	14	14	14A	14
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7	7	7A	14	14	7A
HAWAII	14	14	7A	7	7	7	7	7	7A	14	14	14
INDIA	14	14	7B	7B	7B	7B	7	7	7A	7A	7	7
JAPAN	14	14	14	7	7	7	7	7	7	7	7A	14
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PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	14	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	14	14	14	14	14	7A
U. S. S. R.	7	7	7	7	7	7	7	7	7	7A	14	7

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ARGENTINA	14A	14	14	7	7	7	7	7A	14	14	14	14
AUSTRALIA	14	14A	14A	14	14	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	7A	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7	7	7	7	7A
HAWAII	14	14A	14	14	7A	7	7	7	7A	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	7B	7	7	7	7
JAPAN	14	14	14	14B	7	7	7	7	7	7	7A	14
MEXICO	14	14	7A	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	14B	7B	7B	7	7	7	7A	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	7B	7B	7A	14	14	7A
U. S. S. R.	7	7	7	7	7	7	7	7	7A	7A	7	7
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A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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Selectivity	Adjacent channel interference: 60 DB down at 30 KC
Audio output	1 watt
No. of channels	4

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